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WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING, PRODUCING,
PIPE LINE OPERATIONS AND MANAGEMENT

MAY, 1954

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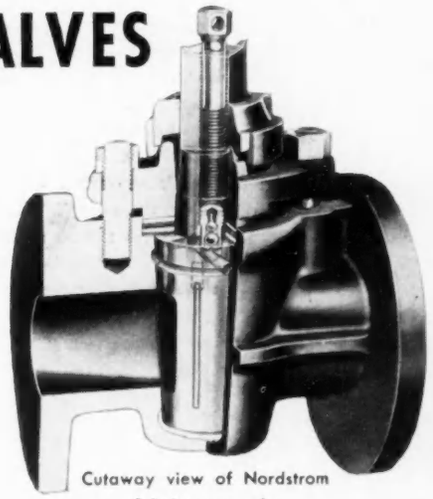

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a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

URRENT OUTLOOK

☐ **No slump indicated.** Equipment purchases last year did not keep abreast of drilling operations. But the condition was no indication of a slump. Rather, it reflected a return to normal buying practices . . . a trend revealed by an extensive World Oil survey of purchasing agents and drilling contractors. Equipment buying ratio with drilling should be more normal in 1954. See Page 64 for the views expressed. **Equipment Purchasing Returning to Normal** ..... **Don Kliewer**

☐ **Demand for petroleum and products** as met by the U. S. petroleum industry is running moderately ahead of last year. In the first three months of 1954, the

Turn the Page ➧

THIS MONTH . . .

total demand averaged 8,757,000 barrels daily, an increase of 273,000 barrels or 3.2 percent over the same period of 1953. This gain is somewhat less than forecast at the beginning of the year by U. S. Bureau of Mines. However it is mostly residual fuel that is not fulfilling forecasts. Exclusive of that byproduct, which is a lesser factor in producing revenue, the demand for oils in the aggregate has been approximately as predicted. Domestic consumption of all oils shows an increase of 367,000 barrels daily or 4.6 percent for the first quarter, but exports were down 93,000 barrels a day or 21.8 percent. See **Page 66** for the complete report. **Oil Demand Up 3.2 Percent in First Quarter**.....**L. J. Logan**

☐ **Sued for $30 million,** the oil industry undertook a remarkable $2 million research program to determine whether it was harming the Louisiana oyster industry; and if not, to show just what was causing the damage. Now, 21 years after the dispute began, scientists have discovered facts which may create new prosperity for Louisiana oyster men and new friends for oil. **Page 68. Oil Lends a Hand to the Bayou Beastie**....**Al Reese**

☐ **What's the outlook in Venezuela?** How does the Venezuelan government view possible U. S. petroleum import restrictions? To find the answers to these and other important questions, WORLD OIL interviewed Venezuela's top petroleum official, Dr. Edmundo Luongo Cabello. Turn to **Page 73** for his answers. **Oil Imports a Matter of Tradition**.....**Robert E. Spann**

☐ **Danger Ahead.** In the Congressional hopper are several bills which would amend the Taft-Hartley law. Some are good and some—particularly those dealing with secondary boycotts—are inimical to industry. Here in easily-read, question-and-answer form are some of the things you should know about this important legislation—and what you should do about it. **Some Proposed Taft-Hartley Changes Are Dangerous to Oil. Page 81.**

☐ **U. S. production of natural gas** is due to climb 12 or 14 trillion cubic feet per year by 1960 from the output of approximately 9 trillion cubic feet in 1953. For more about this prediction, see **Changing Panorama**.....**Page 83**

☐ **Encouraging to the natural gas industry** w the FPC ruling on April 15 in the Panhandle Ea ern Pipe Line Company case. For what this decisi means to the industry and a look at other items interest, see **News Analysis**.....**Page**

EXPLORATION ARTICLES

☐ **A new oil finding method** based on the sa set of factors as those used in electrical well loggi is discussed starting on **Page 99.** Through a system electrodes in contact with and properly distributed ov the surface of the ground, appropriate electrical qua tities are measured and the data processed to produ "polarization index numbers" which are used in plottin polarization charts on "Longcologs." **New Oil Explor tion Method Developed**.....**Anthony Gibb**

☐ **Tests of the effect of temperature** and dep on sandstone indicate that deep burial may cau sands to lose most of their porosity and oil-containi possibilities. It's discussed in the second and concludi part (**Page 102**) of . . . **Low Porosity May Limit Oil i Deep Sands**....**Dr. John C. Maxwell and Peter Verr**

A SPECIAL REPORT
SLIM HOLE DRILLING

Slim hole drilling has been studied . . . and talke about for years. Today the industry is taking a new lo at slim hole drilling. This month, WORLD OIL is devoti its entire Drilling Section to a detailed report on t subject.

☐ **What are some of the questions** raised abo slim hole drilling? More important, what are t answers to these questions on the various technical pro lems? WORLD OIL took these questions to manufacture of slim hole equipment . . . to drilling experts . . . an to engineers and management officials of oil companie See **Page 118** for their answers. **What Are the Sli Hole Problems?**.....**Philip L. McLaughl**

☐ **Tomorrow's slim hole rig?** Some feel it will b a compromise between a diamond core drill ma chine as used in the mining industry and a conventiona rig. For this reason, we are presenting a review by

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter Decembe 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

THIS MONTH . . .

mining industry expert. A comparison of equipment, capital investments, costs and rates of penetration. See **Page 126. Mining Industry Has Used the Technique Since 1875**.....**J. B. Martin**

☐ **The only advantage is economic,** says one of our experts. A comprehensive review of slim hole drilling equipment and practices starts on **Page 132.** This is one of the outstanding drilling articles of the year. **An Engineer Evaluates Equipment and Practices**.....**G. C. MacDonald**

☐ **More about Ohio's rig.** In recent months, The Ohio Oil Company's slim hole rig has attracted considerable attention. Many questions have been raised. Is the rig as good as reported? How would conventional "big rigs" perform in the same area? What problems have arisen? For the answer to these and other questions, turn to **Page 150. Ohio Rig Still Cutting Costs**... **H. D. Hoopman**

☐ **Two slim hole test wells were drilled** by a contractor in Louisiana. The object was twofold.

- Can a 4¾-inch slim hole be logged, drill stem tested, sidewall cored for necessary geologic information?

Turn the Page ➡

NEXT MONTH . . .

WORLD OIL'S JUNE ISSUE will incorporate some of the ideas of industry executives seated above. Left to right: Carlton Speed, consulting geologist and independent operator, Houston; Sam Click, vice president, Illinois Pipe Line Company, Houston; E. E. Miller, chief engineer, Tide Water Associated Oil Company, Houston; J. L. Hoyt, general superintendent, Pan American Production Company, Houston; W. F. Baxter, division superintendent, Kerr-McGee Oil Industries, Inc., Morgan City, La.; and Charlie Graves, vice president, J. Ray McDermott, Company, Harvey, La. At far right is Ray L. Dudley, president of Gulf Publishing Company. Standing, left to right, are J. E. Kastrop, World Oil production editor; Cecil W. Smith, statistical editor; Philip L. McLaughlin, drilling editor; Warren L. Baker, editorial director; L. J. Logan, associate editor; Donald M. Taylor, pipe line editor; Al Reese, managing editor; Don Kliewer, international editor; and Tom W. Nelson, vice president, Gulf Publishing Company.

We've got some BIG ideas for our Gulf Coast Issue!

It'll be readable . . . accurate . . . authoritative and comprehensive.

And no wonder. Look at the help we had. The busy executives pictured above took the afternoon off to sift our story ideas . . . rejecting some, accepting some, and adding their own ideas about what should go into a bread-and-butter, how-to-do-it issue that you'll agree will be tops! Here are just a few of the highlights:

- A complete and newsy roundup of offshore activity and prospects.
- Discusssions of Gulf Coast drilling and production problems and what is being done about them.
- A picture story of the new developments being used in offshore operations.
- A multi-colored insert map showing gas pipe lines and the oil and gas fields of the Gulf Coast.

THIS MONTH . . .

• What are the drilling problems and hazards involved in a 4¾-inch hole?

Beginning on **Page 158,** tables and penetration curves will give you the answers. **What Two Test Wells in Louisiana Found** . . . . . **James W. Arnold**

☐ **A report from Wyoming.** One drilling company drilled a number of deep slim hole wells in Wyoming's hard-rock, crooked-hole country. The second well went 10,266 feet in 4¾-inch hole. Beginning on **Page 164,** the contractor tells you about the equipment used and the problems he faced. He predicts a bright future for slim hole drilling as a means of finding oil at less expense. **Drilling Slim Holes in Hard-Rock Country** . . . . . **Henry B. Brack**

☐ **Conversion of a conventional workover rotary rig** is being studied by one major company. Aspects being studied are crew size, hoisting requirements, height of mast, block loads, hydraulic system, portability, desired hole size, drill pipe, and blowout equipment. Read their findings in . . . **How to Convert a Rig** . . . . . **Page 172**

PRODUCTION ARTICLES

☐ **How do you select the best well-completion program?** It is a recognized fact that how you complete a well may determine the difference between a good or poor producer, or if the well even produces. The Mid-Continent District of API organized a Study Committee on Completion Practices to give the industry the benefit of a specialized investigation of all factors involved. Out of many months of work has come a chart system that will help you select the best well completion method. The new system is illustrated and described in this API report which starts on **Page 189. How to Select Well Completions** . . . . . **Harold M. Dunson and John E. Eckel**

☐ **Dual zone completions offer definite advantages . . .** the most important of which is that of economics. Engineering and design of dual completions have come a long way in the past few years. Here are some descriptions of the latest practices. Practically all basic methods, both for flowing and artificial lift, of dual completions are illustrated . . . the advantages and disadvantages pointed out. See **Page 198** for the full story. **Dual Completion Equipment and Practices** . . . . . **Marshall C. Turner**

PIPE LINE ARTICLES

☐ **Service is selling Americanism** from one end to the other of its vast Wyoming-to-Texas-to-Oklahoma-to-North Dakota pipe line system. In a pioneering educational experiment, Service Pipe Line Company of Tulsa has proven that school-age youngsters, housewives, and all other segments of the nation's population abhor the idea of Communism once it is clear in their minds. Turn to **Page 233** for the story of how Service has brought the fight against Communism out in the open. **Service Is Selling Americanism** . . **Anthony Gibbon**

☐ **A new buoy has reduced costs** of marking underwater pipe lines. It is made of monel-type metal and filled with foam plastic. It is virtually unsinkable, glows in the dark, and is so shaped that it is spotted easily by radar. See **Page** 236 for a description of this new buoy. **Better Marker for Underwater Lines** . . . . . **Nathan H. Jones**

☐ **Zinc anodes have been found effective** in cathodic protection of pipe lines. Turn to **Page 237** for a discussion of their application, including effects of zinc composition and backfill composition . . . what to expect from zinc anodes . . . and their limitations. **Protecting Pipe Lines With Zinc Anodes** . . . . **E. A. Anderson**

INTERNATIONAL ARTICLES

☐ **The Russia of 23 years ago . . .** "The people are being prepared for war with the same painstaking care that characterized the efforts of the last Kaiser." That is but one of the many observations of Author Roy E. Leigh whose article concludes with a thorough description of the Russia of 1930, in the light of which the Russia of 1954 is more easily understood. See **Page 255** for the second and concluding part of **The Land of Nietu** . . . . . **Roy E. Leigh**

☐ **Canada's Pembina development** caught the country with its jobs down. Here are some of the reasons this new discovery—which may develop into North America's largest oil field—is lending a tremendous boost to oil exploration and drilling. **Pembina —North America's Largest Field?** . . . . . **Page 267**

☐ **Turkish approval of a new petroleum law** designed to interest foreign oil companies in the nation's oil possibilities was a body blow to supporters of nationalization. For details of how the law works, see . . . **New Law Signals New Era for Operations in Turkey** . . . . . **Page 270**

Looking Ahead . . .

. . . **A U. S. Supreme Court decision in the Phillips natural gas case** is expected to be announced before the Court's summer recess in early June. The Court heard evidence in the case in early April. The case involves the question of whether Phillips Petroleum Company's gas production is subject to regulation by the Federal Power Commission under the Natural Gas Act.

. . . **A gas turbine designed to operate a passenger automobile** on city street or highway has been developed by an automobile manufacturer. Installed in a current model car, it burned gasoline, with fuel economy matching that of a conventional automobile engine. The gas turbine would satisfactorily burn other fuels within a wide range, from gasoline to heavy fuel oil, it was stated.

. . . **Fourth World Petroleum Congress will be held in Rome** June 6-15, 1955. About 4000 persons from over 30 countries are expected to attend. Programs will include more than 200 papers on petroleum subjects of international significance.

. . . **A higher tax on production of natural gas in Texas,** enacted in a special session of the legislature, will go into effect September 1. It is expected to raise $14 million additional revenue within the ensuing year. The tax will jump from 5.72 percent of value to 9 percent for the first year, drop to 8 percent the second year, and fall to 7 percent the third year and thereafter. The Texas corporate franchise tax will be increased at the same time from $1.25 to $2 per $1000, raising $8.6 million extra revenue; and a raise of the tax on beer from $1.37 to $2 per barrel will boost revenue $3 million a year.

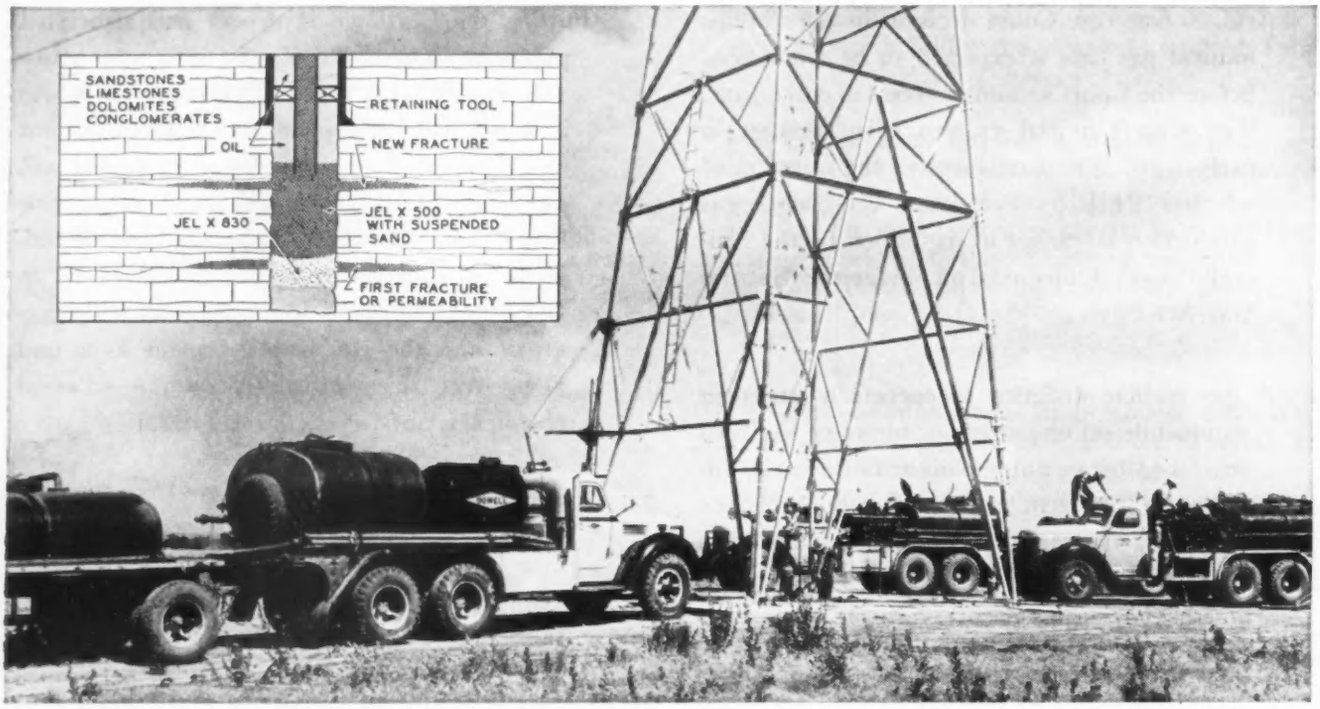
. . . **Putting the Carthage Hydrocol and associated plants at Brownsville, Texas, into operation will require many months.** Stanolind Oil & Gas is buying the idle plant for making gasoline and other products from natural gas and will redesign present equipment and install new equipment. Stanolind also is acquiring the adjacent Brownsville storage terminal of U. S. Industrial Chemicals Company, and will operate it and the gas synthesis plant as a unit along with its previously owned adjacent chemical plant.

. . . **Finding and producing oil and gas from the Gulf of Mexico** is perhaps the biggest assignment ever handed the petroleum industry. The area comprises an oil-rich hunting ground that contains over 132,000 square miles. Only a fraction of it, though, the 14,000 square miles under waters up to 60 feet deep, can be developed with present drilling equipment. Remainder of the area, where waters range up to 600 feet deep, will have to await improved equipment and drilling techniques.

. . . **Argentina contemplates reversing its policy of restricting private development of its petroleum.** The government has been assembling data on existing petroleum laws and regulations in other oil producing nations, including the U. S., with a view to what can be done towards full development of its own reserves. A delegation of Argentine businessmen in the U. S. last month stated that the nation can be expected to adopt legislation assuring fair treatment to existing foreign private investment. Argentina's oil laws since 1935 have prevented private companies from acquiring new acreage for exploration in favor of the government-owned company. The nation, as a result, has experienced an increasing dependence on imported oil.

FIXAFRAC—TEMPORARY PLUGGING SERVICE—AIDS IN MULTIPLE FRACTURING TREATMENT

Production boosted from 2.3 to 65 BOPD; Fixafrac used to divert Stratafrac stages into different zones



Initial production from this well, after acidizing, was 50 barrels of oil per day. It declined over an 18-year period until production had fallen to 2.3 BOPD.

At this point, the operator decided to call in Dowell to determine how to increase production. Dowell's recommendation: a multiple fracturing treatment consisting of 1500 gallons of Stratafrac material and 300 gallons of Fixafrac material.

Dowell engineers performed the service, using Dowell trucks, equipment and fracturing materials. As a result of the treatment, the well swabbed 3½ barrels of oil per hour for 7 hours, after treating materials had been recovered. On pump, the well produced 65 BOPD.

Fixafrac is a temporary plugging service used between stages of Dowell fracturing and acidizing treatments to divert treating fluids into different sections. The material used in Fixafrac service, Jel X 830, carries suspended solids which react after treatment causing the material to liquefy and flow back freely to the well bore. No jel-breaker solution is needed following the treatment.

If you would like to know more about Fixafrac service, or any of the many other Dowell oilfield services, call the nearest Dowell office or write to Tulsa, Dept. E-13.

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Canadian Boom Rolls Along

The amazing growth experienced in Canadian oil development during recent years keeps rolling along. Many signs indicate Western Canada oil and gas activity is on the threshold of further expansion, and should continue growing for years to come.

A new discovery in Canada bids to become the largest oil field in area on the North American continent (see article on Page 267). Fifteen widely scattered producing wells lead some to predict the field, called Pembina, may cover 250,000 acres or more. The vast East Texas field contains only 134,000 proven acres. Pembina, on an 80-acre spacing basis, already has about 2500 proven and semi-proven locations. The first land sale held by the Province of Alberta after the discovery of Pembina saw a record $28½ million paid for reservations and drilling leases in the area.

It is significant that Western Canada is to get its first major market outlet for natural gas. Construction work on the world's longest natural gas transmission line is scheduled to start late in 1954. It will extend more than 2200 miles from southern Alberta to Toronto.

Another natural gas carrier may be constructed to the Pacific Coast, if the Federal Power Commission gives approval for it to serve cities in northwestern United States.

Additional markets for crude oil are to be provided also. The Interprovincial Pipe Line Company at the end of 1953 finished extending its system from Superior, Wisconsin, to Sarnia, Canada. This will provide year-around operations by eliminating the necessity of moving the oil by tanker from Superior to Sarnia. Already, Interprovincial plans an extensive looping of its system between Edmonton and Superior. The Trans Mountain pipe line system will step up its crude purchases as soon as refineries under construction on the West Coast are completed.

All these developments point to stepped up exploration and drilling activity, which surely will lead to the finding of much additional oil and gas in Western Canada.

•

Few realize the proportions already attained by Canadian operations in recent years. Production and drilling activity last year compared with some of the more active regions in the United States.

Production of oil in Canada rose to 81 million barrels in 1953, six times the amount produced in 1948. More oil could have been produced, lack of adequate pipe line outlets was the limiting factor. Canada's producing rates last year exceeded Mexico's production, although the latter nation produced almost five times more in 1948. Canada's production was considerably larger than Illinois' output, slightly more than that produced in New Mexico, and was but slightly less than the volume produced in Kansas.

Canada in 1953 completed 2226 wells. The U. S. was the only nation to drill more wells. Canadian completions were slightly higher than the number of wells drilled in Illinois, far more than in New Mexico, and almost equal to California.

In footage, Canada last year accounted for nearly 10 million feet, nearly twice that of Illinois, slightly more than in New Mexico, nearly as much as in California.

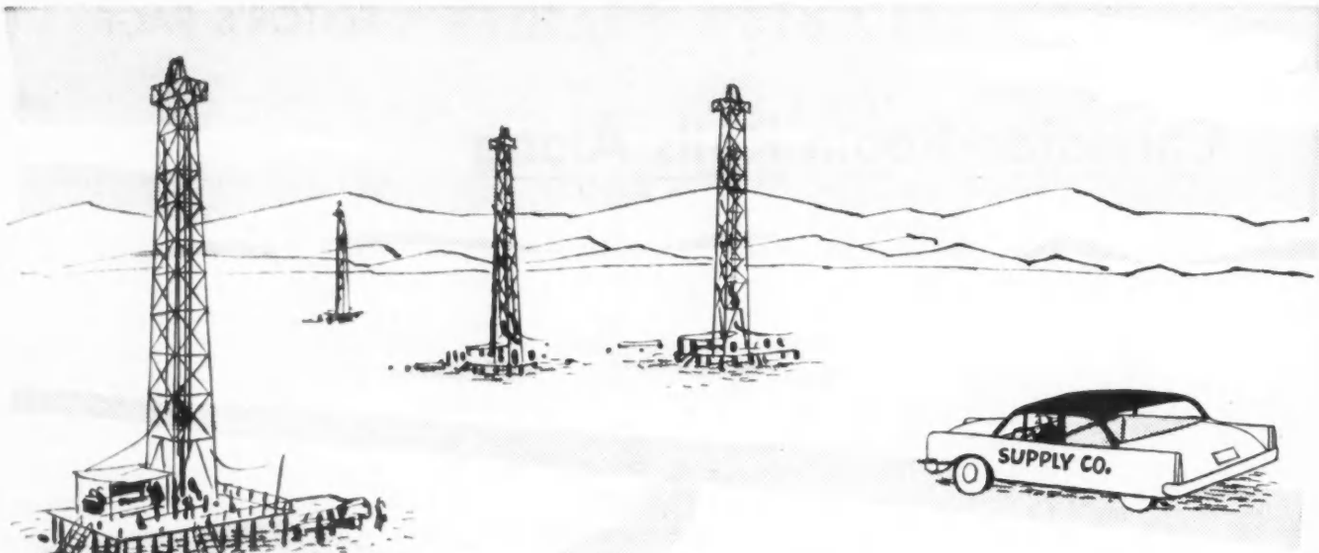
This is an amazing record in view of Canada's small volume of production and drilling prior to 1948. Nevertheless, bigger things can be expected from Canada in the future.

•

Canada's expanded activity is the result of many factors. First, of course, is the fact that vast resources of oil and gas await discovery. The ability of small operators to compete with major companies is another important influence. Many of the producing horizons in Western Canada lie within reasonable drilling depths over much of the area. Furthermore, leasing regulations also are conducive to participation of small operators. In addition, American firms and capital are permitted to operate freely. Hence, numerous concerns and independent oil operators are operating in the area. This means greater competition and faster development rates.

These conditions presage that Western Canada will continue to undergo expanded oil and gas activity. It is to be an active oil region for many, many years to come.

Warren L. Baker



Equipment Purchasing Returning to Normal

Survey indicates some inventory cutbacks are no reflection of an economic slump.

By DON KLIEWER, WORLD OIL Staff

UNBOUNDED CONFIDENCE in the future of this nation's economy and in the continued efficiency of suppliers is seen by oil company and drilling contractor buyers as a major factor in the changing trend in equipment purchases.

A WORLD OIL survey which discovered that many major companies operating throughout the U. S. are reducing inventories to 90-day needs was explained by several executives as being no reflection of an economic slump.

Rather, it is rooted in the certainty of oil companies that the end of the materials shortage and return to a booming peacetime economy guarantees prompt delivery of goods, thereby preventing the necessity of extensive warehousing.

Despite the trend toward trying to hold inventory levels to a minimum, there is little indication of any pronounced reduction in the rate at which equipment and materials are being used. Most of the oil companies and drilling contractors surveyed have been ordering at a fairly constant rate, and are continuing to do so. Actually, some companies announced that no material change in the purchasing rate during the coming year or in the foreseeable future could be expected.

The only qualification to those announcements was—as always—that purchasing will be in direct ratio to operations.

Three questions were asked in the survey of companies and drilling contractors operating on the West Coast, Mid-Continent, West Texas, and Gulf Coast. Representative answers follow.

1. What are your views as to why equipment purchases are not keeping abreast of drilling operations?

"I think it is probably due to inventories and the fact that we're looking for quicker deliveries. The supply situation is generally good, and we don't order as far ahead as we did during the period of shortages."—

Purchasing agent, Gulf Coast division of a major oil company.

"So far as we are concerned, we have become very 'inventory minded.' We are drawing on inventories which had been built up as a cushion against shortages. I consider this a temporary condition, although I do not forsee a return to heavy stocking

of material and equipment unless, of course, shortages return."—

Purchasing agent, oil company operating in the Mid-Continent.

"In our case, purchases of tubular goods have been smaller recently because of a large backlog of foreign-made pipe. This applies directly to tubular goods.

"Now, as regards to other equipment, I'd say that our equipment purchases are not as heavy as before because we are entering a buyer's, rather than a seller's, market. Today, we can order equipment and get delivery within a comparatively short time. Although it may have no appreciable bearing on the situation in general, I might point out that we are reclaiming a lot of equipment from properties which have been unitized. Perhaps other companies engaged in unitizing projects are doing the same."—

Purchasing agent, oil company operating in the Mid-Continent.

Indicative of the trend on the West Coast, one purchasing agent had this to say:

With few exceptions, his company tries to maintain a 90-day supply of all equipment items. This is a long-lived policy, even during equipment controls days, with this company, and it is being adhered to now.

2. Is your company drawing on inventory stocks and does it plan to keep less stocks on hand now that materials controls have been withdrawn?

"Yes, we are drawing on inventory stocks. Of course, as with most of them (other companies) our biggest inventory is pipe, and we are drawing on it. When our pipe inventory goes down, we'll carry less—but not substantially less. We have no real inventory drive. We won't carry much less inventory than we did during the shortage."—

Purchasing agent, Gulf Coast division, major oil company.

"To a certain extent we are drawing on inventory. Tubular goods constitute the greatest inventory in our warehouses and, as the supply situation improves, we shall naturally keep less inventory. In fact, I venture to say that in the course of a year inventory stocks in warehouses may be reduced as much as 50 percent. This will not be too bad for the manufacturer, however, since he will still receive orders and will be able to ship direct from the factory. It will certainly be more convenient for the oil companies and will account for the reduction in warehouse stocks."—

Purchasing agent, Mid-Continent district of major oil company operating throughout the U. S.

Purchasing agents for several companies on the West Coast which contract all wells admit they have been reducing their inventories to "more reasonable working levels," preferring to let suppliers carry the stocks.

3. Will your company's equipment purchases in the future be larger or smaller, and why?

"That is a difficult question to answer, and an answer must be predicated upon the success or failure of current company exploratory and development programs. As of now, I would say our equipment purchases will be about the same in the future as they have been during the past year. But the picture can change."—

Purchasing agent, oil company with extensive operations in the Mid-Continent area.

"They will be about the same. They will be in direct proportion to operations. If a well is brought in as a pumper, we would then buy pumping equipment. Our rigs are serviced about three times a day by suppliers, so we don't inventory anything except a few things—like liners—that we know we are going to need."—

Purchasing agent, Gulf Coast division of major oil company which operates some drilling rigs.

One further factor in equipment purchasing is the apparently widespread effort to check leases more closely to see how material and equipment can be used to greater advantage.

In fact, one purchasing agent of the Mid-Continent district of a major oil company said, "Instead of buying or ordering new material, our company is checking over all its leases to see what can be done to make better use of what we have and to prolong the life of older equipment. We can do this because we know that we can obtain new material without too much trouble. Heretofore, we were inclined to order new material so that we would not be caught short."

West Coast drilling contractors pointed to some decline in equipment purchases of late. However, the decrease has been only a slight one, and, in the cases of some contractors—particularly those operating a higher percentage of heavier class rigs—purchases of equipment have remained steady for some time. Further, a major segment of contractors surveyed agreed they could see little, if any, slackening of activity or reduction in equipment purchases in the foreseeable future.

Contractors surveyed shared the same outlook as purchasing agents. Representative views follow.

"Drilling contractors are using up inventory stocks accumulated during period of shortages. This, naturally, results in less current purchasing of equipment.

"Now that materials controls have been removed, we are going back to normal buying practices; that is, we purchase what we need only when we need it. Knowing that we can obtain quick delivery, there no longer is a need to hedge against possible shortages."—

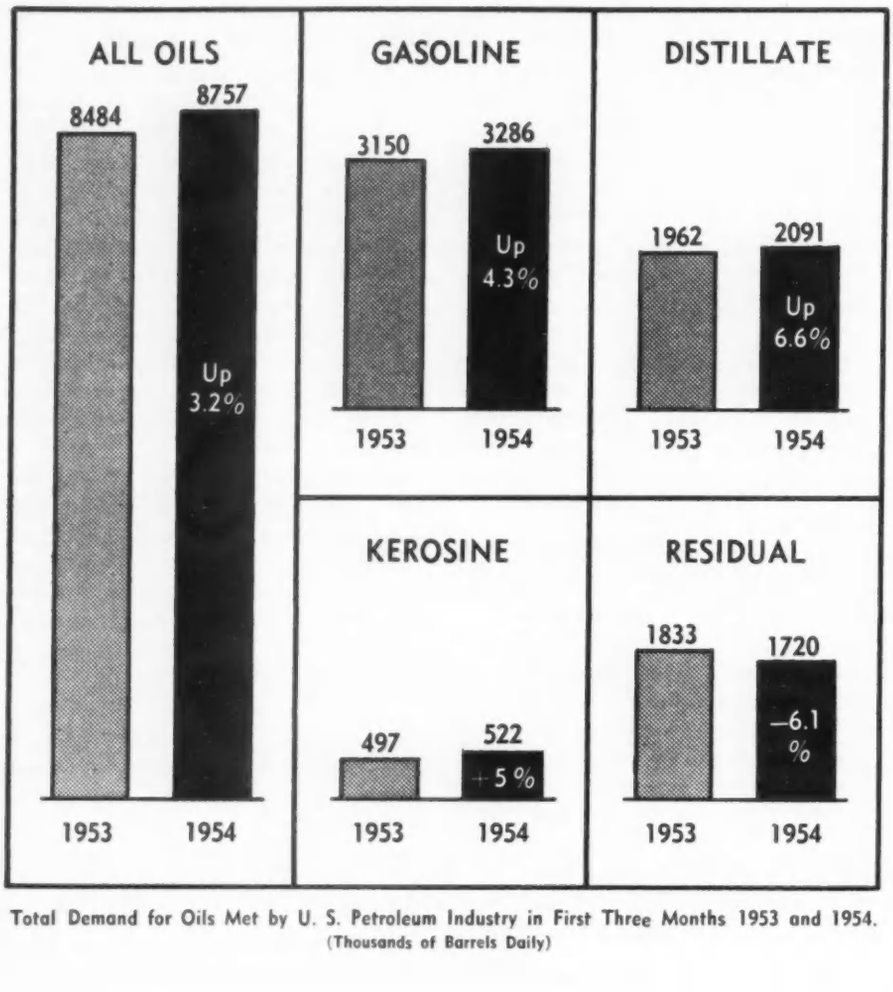
Contractor who operates rigs in Mid-Continent area.

This contractor's views were echoed by contractors operating on a wide scale throughout Texas, Louisiana, Mid-Continent and Rocky Mountain areas.

That, briefly, is the story behind why equipment purchases are not keeping abreast of drilling operations. The answer, apparently, is that inventories are being used so that company warehouses can reduce stocks to working levels and that normal buying—and using—trends are returning.

This survey highlights two facts: reduction in equipment purchasing is due to overstocked warehouses and, therefore, temporary; the outlook for such purchasing is uniformly good, stemming from a general feeling of optimism about future oil operations.

Much of the reduction in oil industry inventory is believed to have occurred during 1953. With drilling in 1954 running well ahead of last year's rate, this leads to the conclusion that the purchase of oil field equipment and material in 1954 is likely to be heavier than in 1953. —**The End**



Total Demand for Oils Met by U. S. Petroleum Industry in First Three Months 1953 and 1954.
(Thousands of Barrels Daily)

Oil Demand Up 3.2 Percent

First-quarter figures show domestic consumption up 4.6 percent, but exports 21.8 percent off.

By L. J. LOGAN, WORLD OIL Staff

DEMAND FOR OILS encountered by the U. S. petroleum industry in the first three months of 1954 averaged 8,757,000 barrels daily. It was greater than in the initial quarter of 1953 by 273,000 barrels daily or 3.2 percent. The demand was somewhat short of expectations. The U. S. Bureau of Mines in its forecast for 1954 estimated an increase of 372,000 barrels daily or 4.4 percent. The actual demand was 99,000 barrels a day less than the forecast.

Demand for gasoline slightly exceeded the forecast, and kerosine demand was exactly as estimated. But distillate fuel oil demand was 98,000 barrels a day less than anticipated, and residual fuel oil was 113,000 a day under the forecast. As residual is a by-product and of lesser importance in providing revenue, its failure to meet as high a demand as forecast was not of great significance. Exclusive of residual, total demand for oils actually was 14,000 barrels a day higher than forecast.

Total demand for gasoline averaged 3,286,000 barrels daily in the first three months of 1954, an increase of 136,000 barrels daily or 4.3 percent over the like months of 1953, and 8000 a day more than forecast. Total demand for kerosine averaged 522,000 barrels daily, up 25,000 barrels or 5.0 percent and exactly as forecast. Distillate fuel total demand of 2,091,000 barrels daily was 129,000 barrels or 6.6 percent above a year ago although 98,000 a day less than forecast. Residual fuel oil total demand of 1,720,000 barrels daily was 113,000 barrels or 6.2 percent less than last year and the forecast, which called for no change.

As expected, an important factor in demand for oils this year is the substantially lower level of exports. Total exports of oils in the first three months of 1954 are estimated at 333,000 barrels daily, down 93,000 barrels a day or 21.8 percent from the first quarter of 1953. The exports have been in line with forecasts. They are lower because new refineries built in Europe and elsewhere abroad are supplying markets that formerly used U. S. oil products.

Domestic demand for all oils in this year's first quarter averaged 8,424,000 barrels daily, up 367,000 barrels daily or 4.6 percent over last year. This gain was less than expected. The forecast for the first quarter called for domestic demand of 8,533,000 barrels daily, an increase of 476,000 barrels daily or 5.9 percent. The actual was 109,000 barrels a day less than forecast.

In domestic demand, as in total demand, actual results fulfilled forecasts if residual fuel oil is excluded.

Domestic consumption of gasoline slightly exceeded expectations and kerosine almost fulfilled the estimate, although distillate fuel oil use was moderately less than forecast. Domestic demand for gasoline averaged 3,197,000 barrels daily, an increase of 150,000 a day or 4.9 percent from a year earlier and a little more than the forecast of 3,189,000 daily. Domestic consumption of kerosine averaged 505,000 barrels daily, up 27,000 a day or 5.6 percent, but not quite up to the forecast of 511,000 daily. Domestic demand for distillate fuel oil averaged 2,024,000 barrels daily, up 167,000 barrels a day or 9.0 percent although 87,000 barrels less than forecast. Residual fuel oil domestic consumption averaged 1,665,000 barrels daily, 100,000 barrels or 5.7 percent less than a year before and 113,000 barrels less than the forecast, which allowed for a slight increase.

Demand for and Supply of All Oils, Crude Oil, Motor Fuel, Kerosine, Fuel Oils and Lubricants

(Sources: U. S. Bureau of Mines except February and March, 1954, from A.P.I.)

THOUSANDS OF BARRELS

ITEM	First Quarter 1953	First Quarter 1954	Percent Change
ALL OILS			
Domestic Production, Total	648,736	633,341	— 2.4
(Daily Average)	7,208	7,037	— 2.4
Crude Petroleum	589,408	570,270	— 3.2
(Daily Average)	6,549	6,336	— 3.2
Natural Gas Liquids	59,227	62,969	+ 6.3
(Daily Average)	659	700	+ 6.3
Benzol	101	102	+ 1.0
Imports, Total	99,507	99,597	+ 0.1
(Daily Average)	1,106	1,107	+ 0.1
Crude Petroleum	55,818	57,158	+ 2.4
(Daily Average)	620	635	+ 2.4
Refined Products	43,689	42,439	— 2.9
(Daily Average)	485	472	— 2.9
Changes in Stocks, All Oils	—15,299	—55,231	+261.0
(Daily Average)	—170	—614	+261.0
Stocks, Beginning of Period	673,754	727,738	+ 8.0
Crude Oil	271,928	276,676	+ 1.7
Refined Products	394,019	440,634	+ 11.8
Natural Gas Liquids	7,807	10,428	+ 33.6
Stocks, End of Period	658,455	672,507	+ 2.1
(Days' Supply)	74	77	+ 4.1
Crude Oil	275,665	267,859	— 2.8
Refined Products	374,522	393,748	+ 5.1
Natural Gas Liquids	8,268	10,900	+ 31.8
Demand, Total	763,542	788,169	+ 3.2
(Daily Average)	8,484	8,757	+ 3.2
Exports, Total	38,369	30,000	— 21.8
(Daily Average)	426	333	— 21.8
Crude Petroleum, Total	6,393	4,000	— 37.4
(Daily Average)	71	44	— 37.4
Refined Products, Total	31,976	26,000	— 18.7
(Daily Average)	355	289	— 18.7
Domestic Demand, Total	725,173	758,169	+ 4.6
(Daily Average)	8,057	8,424	+ 4.6
CRUDE PETROLEUM			
Supply:			
Domestic Production, Total	589,408	570,270	— 3.3
(Daily Average)	6,549	6,336	— 3.3
Imports, Total	55,818	57,158	+ 2.4
(Daily Average)	620	635	+ 2.4
Change in Stocks	+3,737	—8,817	.....
(Daily Average)	+ 42	— 98	.....
Stocks, Beginning of Period	271,928	276,676	+ 1.7
Domestic Crude	263,625	265,515	+ 0.7
Foreign Crude	8,303	11,161	+ 34.4
Stocks, End of Period	275,665	267,859	— 2.8
(Days' Supply)	39	38	— 2.6
Domestic Crude	266,725	256,580	— 3.8
Foreign Crude	8,940	11,279	+ 26.2
Supply, Total	641,489	636,245	— 0.8
(Daily Average)	7,128	7,069	— 0.8
Demand:			
Runs to Stills, Total	630,494	628,951	— 0.3
(Daily Average)	7,005	6,988	— 0.3
Domestic Crude	575,530	571,739	— 0.7
(Daily Average)	6,395	6,353	— 0.7
Foreign Crude	54,964	57,212	+ 4.1
(Daily Average)	610	635	+ 4.1
Exports, Total	6,393	4,000	— 37.4
(Daily Average)	71	44	— 37.4
Transfers to Fuel Oil Stocks	2,023	1,650	— 18.4
(Daily Average)	22	18	— 18.4
Used as Fuel, and Losses	2,579	1,644	— 36.3
(Daily Average)	29	18	— 36.3
Demand, Total, All Crude	641,489	636,245	— 0.8
(Daily Average)	7,127	7,069	— 0.8
Domestic Crude	586,308	579,205	— 1.2
(Daily Average)	6,514	6,435	— 1.2
Foreign Crude	55,181	57,040	+ 3.4
(Daily Average)	613	634	+ 3.4
KEROSINE			
Production, Total	35,882	35,686	— 0.6
(Daily Average)	399	397	— 0.6
Percent Yield from Crude	5.7	5.7	.....
Change in Stocks	—8,832	— 11,285	+ 27.8
(Daily Average)	— 98	— 125	+ 27.8
Stocks, Beginning of Period	27,529	29,070	+ 5.6
Stocks, End of Period	18,697	17,785	— 4.9
(Days' Supply)	38	34	— 10.5
Demand, Total	44,714	46,971	+ 5.0
(Daily Average)	497	522	+ 5.0
Exports, Total	1,672	1,500	— 10.3
(Daily Average)	19	17	— 10.3
Domestic Demand	43,042	45,471	+ 5.6
(Daily Average)	478	505	+ 5.6

ITEM	First Quarter 1953	First Quarter 1954	Percent Change
GASOLINE			
Production, Total	310,106	316,767	+ 2.1
(Daily Average)	3,446	3,520	+ 2.1
Gasoline and Naphtha from Crude	275,793	282,730	+ 2.5
Percent Yield from Crude	44.0	45.0	+ 2.5
Natural Gas Liquids Blend at Refgs.	26,600	27,133	+ 2.0
Nat. Gas Liqs. in other Gaso. Blends	7,713	6,904	— 10.5
Imports, Total	153	.....	—100.0
(Daily Average)	2	.....	—100.0
Change in Stocks	+26,703	+21,039	— 21.2
(Daily Average)	+ 297	+ 234	— 21.2
Stocks, Beginning of Period	136,028	159,949	+ 17.6
Finished Gasoline	127,792	151,129	+ 18.3
Unfinished Gasoline	8,236	8,820	+ 7.1
Stocks, End of Period	162,731	180,988	+ 11.2
(Days' Supply)	52	55	+ 5.8
Finished Gasoline	153,315	171,595	+ 11.9
Unfinished Gasoline	9,416	9,393	— 0.3
Demand, Total	283,556	295,728	+ 4.3
(Daily Average)	3,150	3,286	+ 4.3
Exports, Total	9,306	8,000	— 14.0
(Daily Average)	103	89	— 14.0
Domestic Demand	274,250	287,728	+ 4.9
(Daily Average)	3,047	3,197	+ 4.9
DISTILLATE FUEL OIL			
Production, Total	135,689	135,693	.....
(Daily Average)	1,508	1,508	.....
Percent Yield from Crude	21.6	21.6	.....
Transfers from Crude	598	450	— 24.8
(Daily Average)	7	5	— 24.8
Imports, Total	1,195	918	— 23.2
(Daily Average)	13	10	— 23.2
Change in Stocks	—39,093	—51,148	+ 30.8
(Daily Average)	— 434	— 568	+ 30.8
Stocks, Beginning of Period	98,895	111,944	+ 13.2
Stocks, End of Period	59,802	60,796	+ 1.7
(Days' Supply)	30	29	— 3.3
Demand, Total	176,575	188,209	+ 6.6
(Daily Average)	1,962	2,091	+ 6.6
Exports, Total	9,472	6,000	— 36.7
(Daily Average)	105	67	— 36.7
Domestic Demand	167,103	182,209	+ 9.0
(Daily Average)	1,857	2,024	+ 9.0
RESIDUAL FUEL OIL			
Production, Total	115,150	109,088	— 5.3
(Daily Average)	1,279	1,212	— 5.3
Percent Yield from Crude	18.4	17.3	— 6.0
Transfers from Crude	1,425	1,200	— 81.3
(Daily Average)	16	13	— 81.3
Imports, Total	41,318	39,065	— 5.5
(Daily Average)	459	434	— 5.5
Change in Stocks	—7,106	— 5,491	— 22.7
(Daily Average)	— 79	— 61	— 22.7
Stocks, Beginning of Period	48,706	49,370	+ 1.4
Stocks, End of Period	41,600	43,879	+ 5.5
(Days' Supply)	23	26	+ 1.1
Demand, Total	164,999	154,844	— 6.2
(Daily Average)	1,833	1,720	— 6.2
Exports, Total	6,142	5,000	— 18.6
(Daily Average)	68	56	— 18.6
Domestic Demand	158,857	149,844	— 5.7
(Daily Average)	1,765	1,665	— 5.7
LUBRICANTS			
Production, Total	12,127	12,610	+ 4.0
(Daily Average)	135	140	+ 4.0
Percent Yield from Crude	1.9	2.0	+ 5.3
Change in Stocks	+113	+430	+280.5
(Daily Average)	+ 1	+ 5	+280.5
Stocks, Beginning of Period	11,021	10,070	— 8.6
Stocks, End of Period	11,134	10,500	— 5.7
(Days' Supply)	84	78	— 7.2
Demand, Total	12,014	12,180	+ 1.4
(Daily Average)	133	135	+ 1.4
Exports, Total	2,822	2,600	— 7.9
(Daily Average)	31	29	— 7.9
Domestic Demand	9,192	9,580	+ 4.2
(Daily Average)	102	106	+ 4.2

SAMMY M. RAY, biologist, examines oysters exposed to a continuous flow of brine from oil wells.

CRASSOSTREA VIRGINICA
From oil to oyster: $2 million on the half shell.

DR. J. G. MACKIN, biologist and director of laboratory, studies record from machine which measures salinity of the water. Eight of these machines were used at one time.

Oil Lends a Hand To the Bayou Beastie

When oystermen sued for $30 million, oil countered with a remarkable $2 million research program that may bring new prosperity to the Louisiana industry.

By AL REESE, WORLD OIL Staff

THE DRIVER of the dump truck didn't know he was pointing to a treasure cache of great worth to the oil industry. Nevertheless, he made a grand production of aiming a dark finger at the twin white turrets of the Texas A. & M. Research Foundation Laboratory, standing half on the

JAMES L. BOSWELL, biologist, lifts a tray of experimental oysters from Barataria Bay waters beneath the laboratory.

FRED CAUTHRON, general manager of the laboratory, also has the duty of photographing data assembled by the scientists.

ED SCHRADER, a chemist, reaches for a pair of tongs used to collect oysters for experimental purposes.

sands of Grand Isle, a half in the shallows of Bayou Rigaud.

"There, cher'," he said through a grin that flashed like a white-cap. "That two-small house she's it."

Crammed in that "two-small house" last month were some lofty new ideas and a mass of documented fact which may silence the Louisiana oyster industry's 21-year outcry against oil and bring an early settlement to more than 100 damage suits seeking in excess of $30 million.

The settlement: New prosperity for the oyster, new friends for oil.

This would close one of the oddest chapters in American jurisprudence and provide a magnificent stroke for oil's public relations.

When the first claim was made in 1933 that the Louisiana oyster industry was being destroyed by its gaint neighbor, oil began developing a three-fold program:

1. To ascertain whether oil operations are harmful to the oyster.
2. If not, to point out the oyster's real enemies.
3. To show how to combat effectively those enemies.

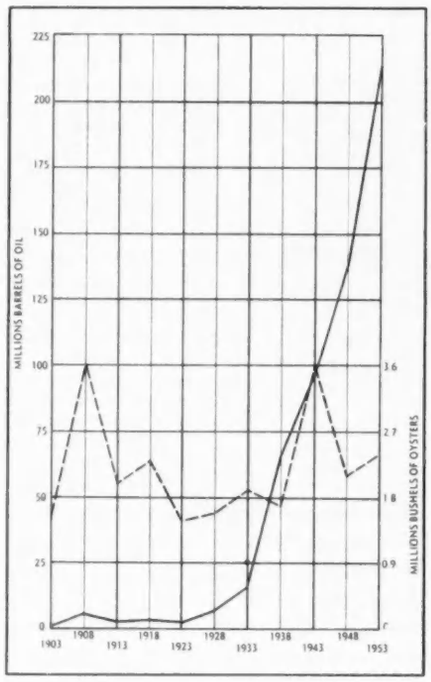
The first two goals were reached four years ago—at least to the satisfaction of oil. The third may be near.

At first glance, oil's expensive efforts beyond proof of its own blamelessness may appear quixotic or charitable. But the facts are more characteristic of an industry that exists to make money. To operate amicably—and profitably—oil needed friends. Thus, it was deemed wise to develop information beneficial to an industry closely cherished by the people of Louisiana.

This is not to say that the magnitude of the litigation to come was apparent from the beginning, or that oil's program was hatched in an afternoon's conference.

Oyster's initial outcry was so feeble, so isolated, that it would have seemed incredible that the echoes would endure for a quarter of a century.

How it began. It was July 4, 1933, when a Humble Oil & Refining Company well blew wild and spilled 3000 barrels of crude over Lake Washington. Though there were many oyster beds in the vicinity, only one owner made a claim. This, without scientific investigation, was compromised for $1500.



INCREASED OIL ACTIVITY in South Louisiana has not been paralleled by a decline in oyster production. Since 1923, when oil production began its tremendous upsurge, the oyster harvest has also increased. Oil production referred to here includes the area south of, and including, Vernon, Rapides and Avoyelles parishes.

At about the same time there appeared on the docket of a Louisiana district court a suit in which it was charged that The Texas Company was destroying oysters in the Timbalier-Terrebonne Bay region. This suit was so valuably vague that it set a pattern for all those to come. Because no such spectacular incident as the Humble well was involved, the suit used the catch-all charge—pollution. In subsequent years the word was repeated in charges broad enough to cover almost every industry operation, from geophysical work through drilling, producing, pipelining and refining—though there is no nearby refining activity.

Doucet vs. The Texas Company languished on the docket until 1942, by which time it was only one of 19 suits involving several companies. It was tried as a test case and the district court held for Texaco. The oystermen appealed and in 1944 the State Supreme Court reversed the decision. The other cases were settled out of court and the oystermen claimed to have received more than $211,000.

Now the gate was open. In 1947 came more suits against Texas, Humble, Gulf Refining Company, Phillips Petroleum Company, Tide Water Associated Oil Company, and The California Company.

First to get moving was Gulf, at present the defendant in more than 60 suits involving claims in excess of $20 million. In December, 1946, Gulf asked Albert Collier, marine biologist, to ascertain whether oil activity was harming oysters; and if not, to find what was causing the mortality. Thus began a four-year effort at Pensacola, under the direction of Sammy M. Ray, a biologist, and at Grand Bay, under the supervision of Joe Bell, a chemist.

Shortly afterwards, The Texas Company contracted with the Texas A. & M. Research Foundation "to conduct to conclusion a thorough, scientific and impartial research . . ." This project was under the direction of Dr. Sewell H. Hopkins of the A. & M. Department of Biology, with the field work supervised by Dr. J. G. Mackin, professor of marine biology at A. & M.

About a year later, the other companies involved in suits joined with Shell Oil Company—which was not being sued—to ally themselves with Texaco in this effort, which was to continue for three years. Ninety men were at one time involved in the study, and more than half this number worked full time for the entire three years.

Experts assembled. Dr. Mackin's work centered on a laboratory built by Texaco at Grand Isle and equipped by the other companies.

Experiments were conducted at Texas Christian University under the direction of Dr. W. G. Hewatt, head of the Department of Biology; at Louisiana State University under Dr. Harry Bennett, professor of zoology; at Texas A. & M. under Dr. Fred Jensen, head of the Department of Chemistry, and Dr. S. O. Brown of the Department of Biology.

Dr. E. J. Lund and Dr. Gordon Gunter carried on research at Port

THE COMPARATIVE INCIDENCE of Dermocystidium marinum in South Louisiana has not been paralleled by a decline in oyster production. Since 1923, when oil production began its tremendous upsurge, the oyster harvest has also increased. Scientists suspect the disease incidence may be quite high in the cross-hatched area just above the derrick, but since there is little oil activity there, no suits have originated from the area.

Aransas. G. Robert Lunz worked at Bear's Bluff near Charleston, S. C.

In addition to these full-time scientists, consultants included Dr. Peter Korringa, head of shellfish research for Holland; Dr. Claude E. ZoBell of the Scripps Institute of Oceanography at LaJolla, Calif.; Dr. Thurlow Nelson of Rutgers University; and Dr. Ray Elsey of the British Columbia Packers.

Meanwhile, on behalf of the state of Louisiana, James N. McConnell, chief of the Division of Oysters and Water Bottoms, enlisted the efforts of Dr. H. Malcolm Owen, now chairman of the Department of Biology at the University of the South, Sewanee, Tenn.

Additional research was carried on at Port Sulphur and Biloxi for Freeport Sulphur Company. This was headed by Dr. A. E. Hopkins, now director of the Gulf Coast Research Laboratory at Ocean Springs, Miss.

Never before had so many brilliant minds probed with such concerted ferocity into the private life of such an unassuming little beast. For three years prior to 1950—and to a lesser extent until now—the oyster was desiccated, emasculated, flagellated and lubricated. It was even equated.*

No less illustrative of the intense scrutiny to which the bayou beastie has been subjected is the quiet joke that blooms midst the antiseptisized erudition of the Grand Isle Laboratory. Biologist James L. Boswell, dignified member of the four-man staff, is said by his straight-faced colleagues to be history's leading practitioner of oyster proctology.**

*y equals M_x (t) x—meaning that "the oyster meat weights are essentially linearly related to the shell capacity for a given season and a given degree of infection."

**Proctology: That branch of medical science dealing with the anus and rectum, their diseases, etc.

Hearsay unacceptable. More than 270 reports were written on the oyster researches. Some covered ground pioneered a half century earlier, for none of the scientists would accept evidence he had not beheld with his own eyes and sifted with his own mind. The fact that they were sponsored by concerns which for the most part had an enormous financial stake in their findings, and their intellectual integrity thus made vulnerable in the opinion of opposing attorneys, apparently inspired an exactitude which transcended their normal caution against acceptance of any but irrefutable data.

Even now, after a long exchange of information, it is frequently impossible to induce one of the scientists to state a conclusion which he himself did not evolve, even though all the others may have proven the point in separate experiments.

The first task was to determine whether oil activity was harmful to the oyster. One by one, they laid the charges under the microscope.

CAN OYSTERS SURVIVE IN WATER COVERED BY A BLANKET OF CRUDE?

To follow the experiments on this problem requires only an elementary knowledge of the beast of the bayous. *Crassostrea virginica,* the commercial oyster of the Atlantic and Gulf coasts, performs one of the most prodigious feats in nature by merely staying alive from the egg stage until it is a month old. In her year-round spawning, which is heaviest during the warm months, a female oyster will release a few million eggs into the water to be fertilized by the male's spermatozoa. Only a couple will normally survive.

After fertilization, the egg divides repeatedly, forming a ball of tiny cells. A little later, the oyster-to-be develops vibrating hairs, known as cilia, which keep it suspended as it is drifted about by wind and current.

Presently this embryo acquires a pair of tiny shells, from between which extends a minuscule foot. Now the roving oyster is a "spat" in search of a home. Upon encountering a piling, a bottle, the shell of a larger oyster, or almost any other firm object, out goes the foot to gum the surface with a substance which quickly turns to calcium carbonate, and the oyster sits itself down for life.

To eat, the beastie opens its shell and pumps water through it by rhythmically beating its thousands of cilia. The water passes over the palps, which strain the microscopic organisms upon which the animal feeds, discarding that which is undesirable. If an abundance of obnoxious substance comes along, the oyster will simply close its "box." If the condition persists, the little beast will continue to clam up and live off its fat for a time.

The oyster's ability to taste though it has no tongue, as such, is tied up with its talent to see though it has no eyes, and to hear though it has no ears. A shadow passing over an oyster's aquarium or a gentle rap on the glass has exactly the same effect as when it tastes something unpleasant. Snap goes the box.

These sensory perceptions are concentrated in the mantle, a film of skin which is a rudimentary nervous system. The mantle dead-ends into the adductor muscle which opens and closes the box.

Recording movement. It was upon the oyster's sensitiveness to environment that one of the comprehensive experiments with crude was predicated. Collier employed a kymograph, a machine to record movement of the shell. Six oysters were placed in separate tanks and each attached to a device which recorded their every movement on a roll of paper. The result is a three-year study of the oysters' likes and dislikes. If the paper used in this experiment were laid end to end, it would be 6000 yards long.

The scientists also constructed boxes which were open at the top,

covered with wire mesh scross the bottom, and which floated with the sides extending several inches above the water-line. Oysters were placed on the wire bottom, the boxes anchored above the animals' natural bedding grounds, and a blanket of crude was poured into the boxes. The oysters survived and apparently were content, for they brought forth little oysters to share their lot.

In another experiment the scientists jetted water through oil for six months into an aquarium containing oysters. The emulsion had no discernible effects.

The latter findings were at odds with experimental results published in 1936 by James Nelson Gowanloch, chief biologist for the State of Louisiana, whose testimony is credited with having helped to decide the issue for the oystermen in *Doucet vs. The Texas Company.*

In an experimental series begun in October, 1933, Gowanloch reported a mortality of 90 percent in oysters subjected to sea water which had come in contact with crude. (WORLD OIL was unable to find any other published report of experiments subsequently made with the same technique and the same ratio of crude-to-water which produced oyster mortality.)

DOES BLEED (PRODUCTION) WATER HARM OYSTERS?

Oysters placed in a large tank and exposed to a constant flow of bleed water were not harmed.

Oysters placed within 80 feet of a production water outlet showed no ill effects.

Oysters were frequently found growing on piling flanked on either side by production water outlets.

At the request of The Texas Company, the Texas A. & M. Research Foundation in collaboration with the U. S. Coast and Geodetic Survey measured the water in Barataria Bay. The assumption was then made that all the bleed water entering the bay would remain there a year. (Actually, the water is changed every few days by the tides.) The ratio of bleed water to total water was then ascertained and the quantity of bleed water multiplied by 1000. This ratio was duplicated in the laboratory and the oysters were placed in a tank of such water. They survived.

DOES DRILLING MUD KILL OYSTERS?

The bottom of an aquarium was covered with drilling mud and oysters placed on it. They showed no ill effects.

WHAT ABOUT GEOPHYSICAL ACTIVITY?

Recent answers to this question have corroborated the findings of exhaustive experiments conducted before the controversy reached its height. In 1944, Gowanloch and McDougall found that 800 pounds of dynamite failed to kill oysters suspended in cages 50 feet from the charge. The team felt that additional work was needed and the following year reported on experiments "in which great care was used to check the validity of the conclusions . . ." In this work they discovered that oysters were not damaged by 400 pounds of dynamite exploded 25 feet under the surface of an oyster bed.

These findings were substantiated time and again in recent experiments which also inquired of the after-effects of geophysical shots. In one test, 50-pound dynamite charges (maximum legal limit) and 20-pound charges (typical operating charge) were set off 20 feet from the oysters, with no apparent harm. Some of the oysters were then moved to another bedding ground. After four months, the percent survival of the oysters remaining at the experimental site was greater than that of those moved away.

WHAT ABOUT DREDGING IN THE MARSHES?

With this question McConnell, the spokesman for 4000 to 5000 members of the Louisiana Oyster Dealers and Growers Association, sent the scientists scurrying into geological history. When he argues that cuts through the marshes for drilling barges or pipe lines have directed the flow of fresh water from the oyster reefs or have smothered the beds with silt, there can be no counter-argument as decisive as setting off a charge of dynamite under an oyster or dunking the beast in crude.

Oyster reefs are indeed silting over and the marginal areas are certainly growing more saline, say scientists, but it is impossible to ignore evidence that the primary causes are:

- *The sea is rising.*

This is attributed to the melting of the polar ice caps and the sinking of the deltaic country, possibly because of the sediment load of the Mississippi River and the compaction of the land.

There is a profusion of literature on this subject, some dating back to 1849. One authority noted in 1930 that many once-prosperous old plantations had been reduced to marsh. Another said in 1936 that surveyed markers on the lower Louisiana delta sank about eight feet in a century. Another offered data in 1941 indicating that the coast at Galveston sank at the rate of 0.19 inch a year between 1909 and 1939.

The thriving mudshell industry offers more evidence. The dredges have dug through 25 feet of mud to bring up pure oyster shell. During the war years a severance tax on this shell by the Texas Game and Fish Commission at the rate of 5 cents per cubic yard amounted to more than $1 million per annum.

- *Man-made levees have changed the entire drainage system of the lower Mississippi Valley, preventing fresh water from reaching the historical bedding grounds of the oysters.*

One of the most striking facets of this bulky subject is the growth of the Atchafalaya River. The Atchafalaya was of such little consequence that it was called a bayou back in 1717, when the initial settlement of New Orleans was held up by floods. But since that time the Mississippi has been imprisoned virtually its entire length by levees which at some points are 35 feet high; and engineers now believe the Atchafalaya will some day be larger than the Mississippi unless means are taken to contain it.

To emphasize how recently this change has taken place, Dr. Gordon Gunter recalls talking to an old Creole gentleman who drove cattle across the Atchafalaya at a ford during low water stages approximately 85 years ago.

The significance of these alterations in the delta drainage system was

summed up for WORLD OIL recently by Dr. Owen of Sewanee, former consultant for the State of Louisiana:

> ". . . it is my personal conclusion that the primary cause of the debilitation of the oyster industry in Louisiana in the area west of the Mississippi River is due to a lack of nutrient-bearing fresh water. The cutting off of Bayou La-Fourche from the Mississippi River and the lack of outlets from the Mississippi River south of New Orleans has created an environment which is not conducive for the successive maintenance of oyster communities. The result of such an adverse environment has been to create an endemic area for parasites and predators which under certain conditions become the controlling organisms in the oyster community. From a constructive standpoint it is my personal opinion that this condition can be alleviated by proper engineering procedures to introduce river water into this area at the proper time and under controlled conditions."

Enter the villain. Of particular import is Dr. Owen's assertion that the conditions bringing increased salinity have created an area favorable for parasites and predators.

The possibility of parasitic damage did not occur to investigators who as early as 1904 noted an increase in predators* when salinity was high in areas where oyster reefs were dying. But modern scientists attach great significance to the fact that high salinity encourages the ravages of

Dermocystidium marinum.

Dermocystidium (pronounced Der′-mo-cys-tid′-i-um), discovered in 1950, is a fungus which literally devours the oyster alive, destroying in progressive stages the blood vessels, digestive system, heart and adductor muscle. In form a spherical cell, it may be remotely related to several fungus infections which attack man.**

After exhaustive tests which led to the conclusion that Dermocystidium costs the Louisiana oyster industry about $2 million a year—or roughly 40 percent of the total value of the 1953 crop—the scientists closed the second phase of their investigations. Experimentation as to whether oil activity causes oyster mortality had shown negative. The disease source had been proven.

A new research setup was organized with Dr. Mackin directing the Grand Isle work with the aid of Ed Schrader, a chemist; Fred Cauthron, photographer and general manager of the laboratory, who also has bachelor's degrees in chemistry and biology; and James L. Boswell, biologist. Dr. S. H. Hopkins is consultant to the group.

The studies were augmented by Sammy M. Ray, who had participated in the Gulf Refining project until that company completed its independent efforts and joined the other companies in 1950. In that year Ray enrolled as a graduate student at Rice Institute to carry out investigations in the life cycle of Dermocystidium under the direction of Dr. A. C. Chandler. It was Ray who found the now-famed thioglycollate culture technique by which it is possible for even an untrained eye to recognize the disease without aid of a microscope. The technique is to cover the cultured oyster meat with iodine. If it turns blue, it is heavily infected.

Present goals. Recent efforts at Grand Isle have resulted in evidence that the disease is more prevalent in areas of high oyster mortality than in areas of low mortality.

Dr. Mackin is also working on several experiments which may bring immediate financial benefits to the oystermen. Most phases of this work may not be disclosed because his theories have not been proven under all conditions, but some have reached the conclusive stage.

Oystermen would like to transplant their spat from the east (seed grounds) to the west side of the lower delta in any month from September to April and allow them to develop until the second or third winter.† However, high mortality during hot weather in very saline areas has forced them to transplant in September, October and November, and to harvest before the next summer. This results in a marked decrease in the production of prime, or counter, oysters.

Dr. Mackin's plan would take advantage of well-substantiated data that (1) Dermocystidium is most active in the summer months;‡ and (2) that oysters less than a year old are not nearly so susceptible to the disease. He is prepared to suggest to the oystermen that they transplant at the end of the summer, leave the oysters on the reefs through the next summer, when they are all but immune to the disease, and the next winter, and harvest them about March of the year after that. He would also transplant the oysters when they are only hours old, rather than several months or a year old, as now.

In actual field experiments, working in areas of high endemic disease, Dr. Mackin has harvested oysters 3½ to 4 inches long by this technique.

Experiments are also being made in shifting oysters to comparatively fresh water in the summer to avoid high incidence of Dermocystidium, and shifting them to areas of greater salinity in the winter, when the disease incidence is low. This is based on data which show that oysters fatten better in areas of high salinity—unless the disease interferes.

The rewards. More information beneficial to the oyster will be divulged as the work continues. As of now, after several years of effort and at a cost of $2 million, oil has:

- Made *Crassostrea virginica* one of the best-documented beasts on earth;
- Held its friends and made new ones; and
- Opened the way to great prosperity for the Louisiana oyster industry.

—The End

*Predatory enemies of the oyster, in order of their importance, are the drilling snail (conch), stone crab, blue crab, Stylochus (a worm) and drumfish.

**Notably blastomycosis, cryptococcosis. Dermocystidium, however, cannot be transmitted to man, nor indeed have the biologists been able to transmit it to the clam, oyster's close kin.

†The efficiency of this method is doubted by some on the grounds that a crop of very large oysters every two or three years would not bring as much as several crops of smaller oysters.

‡Also true of the oyster's other enemies.

with Dr. Edmundo Luongo Cabello
Venezuelan Minister of Mines and Hydrocarbons

Oil Exports a Matter of Tradition

- **Venezuela's No. 1 oil official says production will be guided by considerations based on inter-American cooperation as well as MER and market fluctuations.**
- **How would return of Iranian oil affect Venezuelan production?**
- **What are prospects for new discoveries in eastern Venezuela?**
- **Here are the answers to these and other important questions.**

Venezuela's oil! As the second largest producing nation, the world has an important interest in Venezuela's oil. As was proven in World War II, Venezuelan oil is essential for the defense of the free world. During some future world emergency, Venezuela's oil, along with that in the U. S. and Canada, possibly could be the only major source of petroleum to free nations.

Petroleum in Venezuela is a partnership between each of 13 producing companies and the Republic of Venezuela. The nation's 1943 Petroleum Law proved to be an important milestone in foreign petroleum operations in that it set the pattern in existence today that subsurface owning governments now demand an equal sharing in profits from oil operations with producing companies. Other features of the Venezuelan petroleum law have been written into the new laws of several producing nations.

Producing companies in Venezuela have cited their relationships with the government as an excellent example of friendly cooperation. The relationship between the producers and Venezuela has proven to be of mutual advantage.

To find out some of the reasons for the successful operations in Venezuela and to learn first-hand of the outlook for the future, the Venezuelan Government's views on the important issue of possible restrictions on petroleum imports to the U. S. and other topics, WORLD OIL sent Editor Robert E. Spann to Caracas to interview the top government petroleum official, Dr. Edmundo Luongo Cabello, Minister of Mines and Hydrocarbons. Dr. Luongo is a career man in the ministry and, until his appointment by President Marcos Pérez Jiménez as minister, served in several important positions in the Ministry of Mines and Hydrocarbons.

By ROBERT E. SPANN, WORLD OIL Staff

Q *Venezuela's oil production last year averaged 1,745,381 barrels daily, representing a 3.2 percent decline from 1952. What were the factors attributing to this decline and what will be the influence of the factors during 1954?*

A Venezuela's production has always been below the potential. The average daily production for 1953 was 3.2 percent below that for 1952. This decrease in production was affected voluntarily on the part of Venezuela as a measure leading to the relief of the petroleum markets of the Western Hemisphere, in particular that of the United States; hence this decrease was due to an effort to cooperate with the U. S. During 1954 the production will also be subjected to the same policy.

Q *How do you regard the possible return of Iranian oil as a possible threat to displacing some of Venezuela's production?*

A The temporary loss of Iran's production did not in any way benefit Venezuela; hence it is not expected that any harm will result from its return to the world market. This supposition is strengthened by the news that Iran's production is expected to enter competition gradually. Most likely Iran's production will be amply absorbed by increasing world demand.

Q *Sir, what percentage of Venezuela's Federal revenues are derived from the petroleum industry? Has this*

percentage increased or declined during the postwar period?

A Approximately 60 percent of the total national income can be attributed to the oil industry. The 60 percent includes an increase of not less than 20 percent with respect to the amounts obtained prior to 1943. (Editor's Note: The 50-50 sharing of profits from oil operations with the government commenced with enactment of the 1943 Petroleum Law.)

Q *In view of the above, Dr. Luongo, what were the economic effects of the decline in crude oil production last year on the Venezuelan economy?*

A The decrease in production during the past year did not have any effect worth considering on the economy of the country.

Q *Should the increase in petroleum availability in 1954 dictate a further cutback in Venezuela's production, how would it be affected?*

A With or without an increase in world-wide available oil supplies, Venezuela will maintain its realistic production policy. This policy is based on the following points:

- Production shall not exceed the most efficient rate estimated for each field;
- Production will be subjected to considerations based on inter-American cooperation;
- Production will be made to follow market fluctuations as far as permitted by points 1 and 2.

Q *What are the natural markets for Venezuelan oil?*

A Venezuelan oil is exported mainly to the U. S., Europe, South America and Canada. The percentages are, respectively, 38 percent, 17 percent, 15 percent and 10 percent.

Q *As the largest importer of Venezuelan oil, Dr. Luongo, U. S. producers are faced with curtailed production and high inventories of refined products. A large number of U. S. producers fear that continued high imports will bring serious economic hardships. In view of this feeling, is the Venezuelan government desirous of seeing an increase in U. S. imports of Venezuelan oil, say higher than the volume imported from Venezuela in 1953?*

A Any criticism aimed at Venezuela by those interests in the U. S. which complain of the so-called high rates of oil imports, can be answered by the following points:

- With due consideration being given to normal variations in demand, exportation of oil to the U. S. has been maintained at its traditional level;
- In order to cooperate in this respect, Venezuela voluntarily decreased its production.

Venezuela does not expect a sudden increase in American imports, but merely the preservation of the status quo, with logical increases dictated by the demand.

Q *The critics of U. S. imports reason that dependence on foreign oil could endanger the U. S. industry. Don't you feel that a strong U. S. petroleum industry is essential for the long-range well-being of all of the Western Hemisphere?*

A Yes, it is. It is also essential to the welfare of the Western Hemisphere that Venezuela have a strong, well-developed oil industry. As proof of this statement stand the generous, altruistic and unlimited contributions made by Venezuela during the two World Wars.

Q *What is the domestic demand for petroleum in Venezuela? What do you think will be the rate of annual growth in the future years?*

A Internal consumption of oil in Venezuela was of more than 35 million barrels in 1953, an increase of more than 100 percent over 1948. It is expected that internal demand will continue to increase at this rate.

Q *What primarily will influence the higher consumption of petroleum in Venezuela?*

A The most important factor affecting an increase in the internal consumption of oil is the growing developments of the country.

Q *What about use of automobiles, have registrations shown much of an increase recently?*

A The increase in vehicles registered in Venezuela (exclusive of those used by the Armed Forces) can be appreciated from the following figures: 36,951 in 1942; 84,476 in 1948; 165,621 in 1952. During these three years gasoline consumption was 48 million, 155.8 million and 296 million gallons. (Editor's Note: A recently announced automobile registration figure for 1953 placed the total in Venezuela, exclusive of Armed Forces at more than 220,000.)

Q *Dr. Luongo, what is your estimate of the most efficient rate of production of all of Venezuela's fields?*

A For Jan. 1, 1954, the most efficient rate of production of all fields has been calculated to be 2,022,818 barrels per day.

Q *How is the MER computed for Venezuelan fields?*

A The most efficient rate of production is calculated separately by engineers of the ministry and the oil companies for each field. The figures obtained are then adjusted to arrive at the final result.

Q *What has been the ratio of actual crude oil production to MER in Venezuela during the last few years?*

A For January 1 of 1952 and 1953, the ratio of production to most efficient rate was 94 percent and for Jan. 1, 1954, it was 92 percent.

Q *During World War II, some of Venezuela's fields were producing in excess of MER, were they not, to supply the Allied Powers with needed oil?*

A During the last World War every possible effort and even certain sacrifices were made to supply oil to the Allies; so that some fields were allowed to produce at rates higher than the most efficient rate.

Q *Does the Ministry of Mines and Hydrocarbons permit crude oil production in excess of MER at present?*

A No.

Q *Oil companies now hold concessions on about 15.5 million acres, or about 6 percent of the total area of Venezuela. How large an area do you think will show geological promise of oil in Venezuela?*

A There are about 35 million hectares (86.5 million acres) of sedimentary basins in which oil deposits may exist. Of this are about 17.9 percent is covered by concessions.

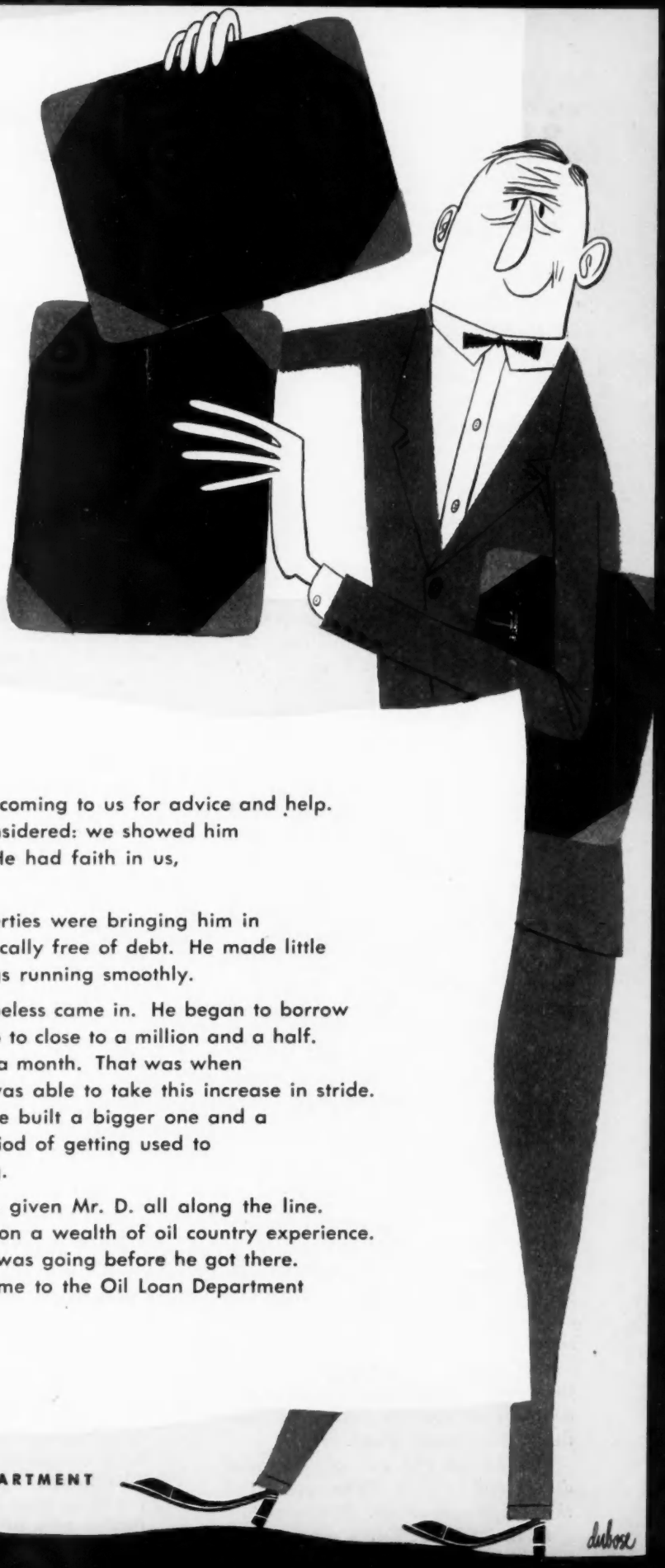
Q *The Ministry of Mines and Hydrocarbons has projected a broad oil and gas conservation program. What are the objectives of this program?*

A The national government is very interested in the conservation program. The object of the program is to obtain the maximum recovery from the reservoirs, the minimum waste and maximum use of natural gas, using the energy in the production of oil, as fuel or as raw material in the petrochemical industries.

Q *During 1953, some 26 percent of the casinghead gas produced was utilized in Venezuela. Was that an important increase over the previous year?*

A Yes, since the utilization during

Mr. "D" came for advice



When Mr. D. first got started he began coming to us for advice and help. We helped him in a way that he had not considered: we showed him the need for building a good organization. He had faith in us, and he did build a good operation.

Mr. D. was doing pretty well. His properties were bringing him in around $25,000 a month, and he was practically free of debt. He made little deals all the time, just enough to keep things running smoothly.

Then a wildcat that was considered hopeless came in. He began to borrow to define his field limits, and his debt ran up to close to a million and a half. But his income jumped to around $100,000 a month. That was when Mr. D.'s organization paid off for him. He was able to take this increase in stride. With the nucleus of a strong organization, he built a bigger one and a strong one. Instead of having a difficult period of getting used to bigger operations, he sailed smoothly along.

We are proud of the help that we have given Mr. D. all along the line. We helped him with impartial advice based on a wealth of oil country experience. We helped him because we knew where he was going before he got there. This sort of help is why oil men **going up** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

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the year 1952 was only 17 percent in relation to gas produced.

Q *Do you expect that the use of casinghead gas will show a large increase over the next few years?*

A Yes.

Q *Who will be the major consumers of this gas?*

A The main consumers will be the oil companies themselves who use the gas in pressure maintenance projects, recycling, etc., and in the second place, the other industries.

Q *What percentages of the total gas produced do you think will be used in the repressuring operations in the next few years?*

A The development of gas repressuring projects is growing every day. At the present time, in accordance with these projects, approximately 10 percent of the gas produced is returned to the reservoir. It is expected that in the next four or five years the percentage shall increase to 40 percent.

Q *What were the important new oil discoveries in Venezuela in 1953?*

A The principal discoveries in 1953 were accumulation of crude oil of the Eocene, found for the first time in the Tía Juana area, and the discovery of commercial production in the fissures of the basement in the fields of La Paz and Mara in Western Venezuela. To these, other discoveries made in the Campo Siglo, Suelo, Zorro, La Ceibita and Mata Norte fields, in Eastern Venezuela, should be added.

Q *What do you consider of the prospects for the Barinas-Apure area where some exploratory operations are underway?*

A The areas of the Barinas-Apure basin are promising for the oil industry.

Q *What are the prospects for additional discoveries in Eastern Venezuela during the next few years? Do you look for many more major discoveries on the presently-held concessions?*

A The government expects that in the future years new discoveries will be made in Eastern Venezuela, continuing the present trend.

Q *What is the outlook for total drilling in 1954 in Venezuela? Will the completions exceed 1953's total?*

A In 1953, 1016 wells were drilled, and it is expected that in 1954 the drilling operation shall be maintained at a similar level. —The End.

The Courts Say . . .

in recent insurance cases

Shelton

This column is to inform—not advise. It presents the current trend in legal thinking on insurance cases. The law varies from state to state and its application depends upon the facts of the particular case. Do not attempt to apply it without consulting your attorney.

By Joseph M. Shelton, Attorney at Law, Dallas

That insurance carrier was charged with correctness of medical report made by employer's doctor

EMPLOYE was examined prior to employment by a certain doctor regularly used by employer. Employe suffered an injury to his back and was treated by the same doctor, who told him he would be all right in a couple of weeks. Insurance adjuster later contacted employe and exhibited a carbon of a written medical report of the doctor, stating that employe would be all right. Employe signed a settlement agreement which he sought to set aside some 3 or 4 years later on the basis of fraud in the procurement of it. The trial court instructed a verdict in favor of the insurance carrier. The employe appealed.

The court said that the use of the employer's doctor's oral opinion and his written opinion to influence the settlement was in effect an adoption by the insurance carrier of the employer's doctor and made the doctor's statements binding upon it. The carrier was charged with the correctness of the report and the evidence on the trial raised an issue as to the correctness which was for the jury to determine. The court was in error in instructing a verdict for the carrier.

—Vinyard v. Texas Employers Ins. Ass'n.
263 SW 2d 675 (Tex. Civ. App. Dallas, 1953)

That employe must prove exposure to greater hazard than general public when a victim of heat stroke

EMPLOYE suffered a heat stroke or heat exhaustion while working on a job as a carpenter's helper. He claimed to have been permanently injured about the head, neck, arms and entire body as a result. On trial to a jury it was found that employe was suffering from permanent injuries which occurred while on the job in the course of his employment. The insurance company appealed, claiming the employe had failed to show he was subjected to a greater hazard from the act of God than was the general public.

The Texas Court said that the employe had, in effect, claimed his injury was caused by an act of God and it was incumbent on him to show that he was engaged in the performance of duties which subjected him to greater hazard than ordinarily applied to the general public.

—Traders & General Ins. Co. v. Ross
263 SW 2d, 673 (Tex. Civ. App.—Galveston, 1953)

That employe on plant construction was not a casual employe

EMPLOYE had worked for defendant regularly for six months as a general laborer. At the end of that time, he was laid off because of slack business. Employe was called back to help with some specific construction work. While so occupied, he suffered an injury to his back. Employer denied compensation on theory that construction work was not in the usual course of Employer's business.

The Tennessee Court said the rule upon which the employer relied was not to be extended to regular and general employes about a plant in connection with its usual business who happen to be at the time of the accident engaged, under supervision and direction of employer, on work of a repair or construction character.

—Rhyne v. Lunsford
263 SW 2d 511 (Tenn. Sup. Ct., 1953)

A WORLD OIL INTERVIEW

with F. ROE WEISE, Associate Director
Industrial Relations Department
Standard Oil Company (Indiana)

Some Proposed Taft-Hartley Changes Are Dangerous to Oil

Q. *What do you think of the Taft-Hartley Law as it now stands?*

A. I think it is a pretty good law. There are a few things our experience would lead us to change, though. Some of these changes would be in the direction of providing better protection for employes. Some of them would be to define a little more clearly the rights of the employers. Most important, others would be designed to look after the interests of the public.

Q. *What are your general views on the amendments requested by the President in his recent message?*

A. I think some of them would improve the law, others would damage its effectiveness.

Q. *Which of the amendments requested by the President are, in your opinion, of greatest importance to oil industry?*

A. These are the ones I think the oil industry should be most interested in:

- The amendment which leaves it up to the General Counsel of the National Labor Relations Board to decide whether he will seek an injunction in a secondary boycott case.
- The amendment making lawful a boycott against an employer doing "farmed out" work.
- The amendment providing that fact-finding boards appointed under the National Emergency Provisions may not only find facts but may make recommendations as to the terms of settlement.
- The amendment increasing "states rights" in the handling of labor matters.
- The amendment providing for a secret strike ballot.

Q. *What difference does it make to the oil industry whether the General Counsel* is required *to get an injunction in a secondary boycott case or simply* may *if he sees fit?*

A. Government officials sometimes find that it isn't politically desirable to rile a labor union. If they have an option, therefore, they are likely to find some excuse for not taking action against the union. If they have no choice, they will go ahead and do their duty. We saw an instance of this during the oil strike of 1952. One of the storage and carrier outfits has a terminal at Chicago. Many of the struck companies normally store products and haul out of there, supplying the city of Chicago. The striking unions put up a picket line around this terminal. Contract carrier truck drivers refused to go through it. This was a secondary picket line because there was no dispute between the terminal proprietors and the picketing unions. The General Counsel's office of the National Labor Relations Board told the union that they would get an injunction if the picket line continued. The picket line came down. I cannot prove it, of course, but I am satisfied in my own mind that if it hadn't been mandatory that the injunction be obtained, the board would not have taken action. As a result, the city of Chicago would have suffered hardship. The industry should oppose this change.

Q. *How does this "farmed out work" provision affect the oil industry?*

A. As the law now stands, a union having a dispute with Company "A" cannot picket the plant of Company "B" who is making a product which will be sold by Company "A" to its customers. That is because the union has no dispute with Company "B" and, therefore, its picketing would be a secondary boycott. Under the proposed amendment, such picketing would be lawful. This is dangerous to the oil industry because of its intermingled products, exchange agreements, etc. One barrel of "farmed out work" could render a 100,000-barrel refinery subject to picketing. The industry should oppose this one with vigor.

Q. *I understand you consider it undesirable for emergency fact-finding boards to make settlement recommendations. Why?*

A. We have had some experience with this. Do you remember when the Wage Stabilization Board made recommendations in the steel case? These recommendations were used as the basis for President Truman's seizure of the steel industry. He virtually said to steel, "You agree to the recommended basis or I'll seize you." At about that time the oil cases were before the Wage Board. We were very fearful we would meet the same fate as steel. It happened we had another basis to refuse to appear before the board and thus were saved. Later, and we can be very thankful for this, the Supreme Court held that the President has no right to make such seizures. I feel that panel or board recommendations as to settlement terms bring us one step closer to compulsory arbitration, which, I think, is

Continued on Page 94

THE BAKER JUNK BASKET safely traps, retains and removes from the well cuttings from "drilled-out" cast-iron, aluminum alloys, bronze or other dense, but "drillable" materials. Its design is simple and sturdy, and is readily understood by referring to the sectional illustration (upper right). Between the short Drill Collar (top) and the Drill Collar Sub (bottom) a Cylinder is mounted to provide a basket for trapping a considerable quantity of metal cuttings. When drilling out Baker Cement Retainers, Baker Bridge Plugs, Baker Production Packers, or other devices made of cast iron, aluminum alloys and similar "drillable" materials, a Baker Junk Basket (Product No. 4281) is positioned just above the rock bit, or diamond point bit.

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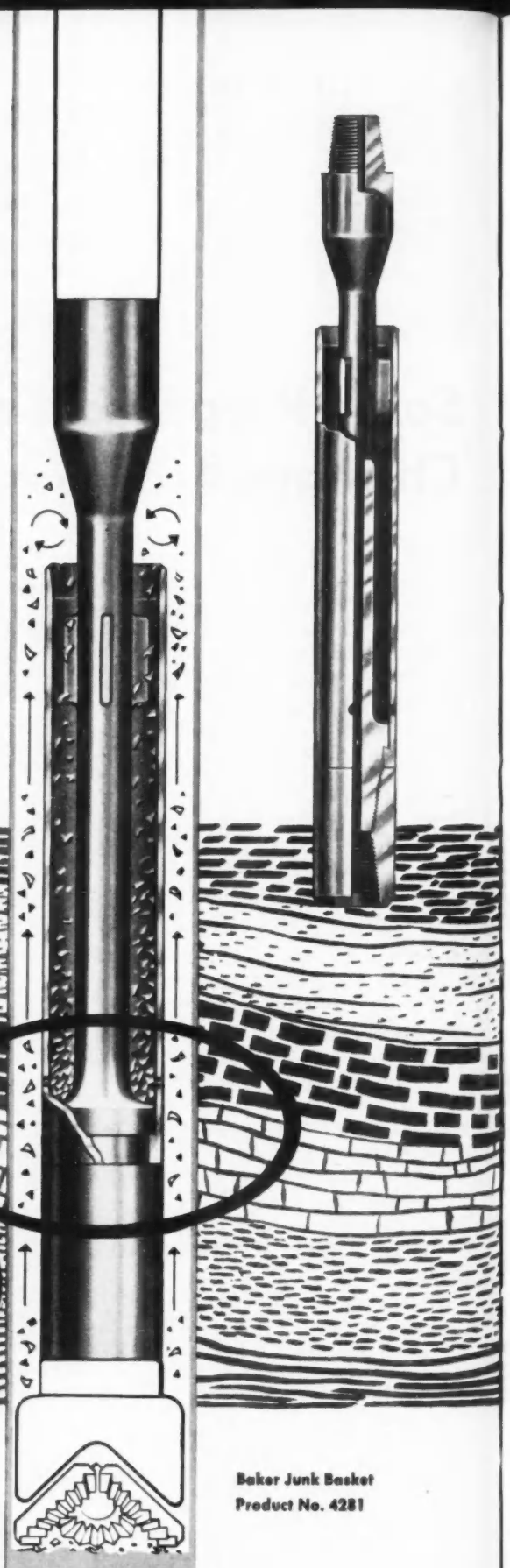

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Can Detergents Scrub Oil Sands?

A comprehensive research program designed to aid development of new and improved methods for more complete production of petroleum from partly depleted reservoirs is being conducted at the Bureau of Mines Experiment Station, Bartlesville, Oklahoma.

Water-flooding has accounted for much of the petroleum produced by secondary-recovery methods; however, a considerable portion of the crude oil commonly remains in place after water-flooding has been terminated.

In recent years the possibility of increasing the efficiency of water-flooding by using surface-active additives has received wide attention. In general, the results of laboratory research have shown that use of detergents as water-flooding additives will reduce the residual petroleum in porous media.

Some less extensive field tests have supported this conclusion but have not been entirely conclusive. Later studies have given conflicting evidence as to the relative worth of detergent additives for water flooding in water-wet (hydrophilic) or oil-wet (hydrophobic or lipophilic) reservoir materials.

The results of these studies emphasize the need for a more complete understanding of the fundamental principles involved in displacing petroleum from reservoir surfaces by injected fluids. Accordingly, a comprehensive research program was initiated to investigate the practical and fundamental aspects of detergency in petroleum production.

Development of new detergents, particularly of the nonionic type, offers new possibilities in this field. The results of investigation by Bureau of Mines personnel involving four series of nonionic detergents were reported last fall.

The latest report on this important subject (Bureau of Mines R. I. 5020 entitled: "Displacement of Petroleum From Sand By Detergent Solutions" Dunning, Hsiao and Johansen), deals with displacement of petroleum from oil-wet sand surfaces by solutions of 56 detergents of various compositions and relates this effect to the more common properties of the detergents, such as surface activity, solubility, hydrophilic-lipophilic balance (HLB) and adsorption at the sand-water interface.

Increased Recovery Seen in Scurry

Through the water-flood program that is now being inaugurated in the Scurry County Canyon Reef field, West Texas, oil recovery may be more than doubled. A recovery of 1,460,000,000 barrels with benefit of the program is estimated. This is 795,000,000 more than the 667,000,000 barrels estimated as recoverable by primary means.

The program embraces 46,077 unitized acres. There will be line-type water injection in 53 wells that follow the approximate centers of the Canyon Reef production in the Kelley-Snyder and Diamond "M" fields and injection of gas in three wells at the extreme north edge of the field.

All necessary equipment, including water lines, pumps, and water treating facilities, is being installed.

The water supply will come from the Colorado River Water District's lake 10 miles southwest of the southern limit of the unit. A 27-inch water line joins an old 21-inch line serving the town of Snyder, and three water injection stations being built will be served by 18 and 20-inch lines.

The operators in the field are working together in the program through the Scurry Area Canyon Reef Operators Committee. Operation of the project is supervised by H. H. Allen, Snyder Unit manager, and a staff of SACROC engineers. For operational purposes the unit has been divided into three segments, operated respectively by Standard Oil Company of Texas, Magnolia Petroleum Company, and Sun Oil Company.

Output of Natural Gas Due to Climb

U. S. production of natural gas probably will climb to 12 or 14 trillion cubic feet per year by 1960 from the output of approximately 9 trillion cubic feet in 1953.

This prediction has been made by Lyon F. Terry, vice president of the Chase National Bank, New York, author of numerous papers on the economics of the natural gas industry.

"The growth of the gas utility industry at the remarkable average rate of 10.3 percent per year since 1945 cannot be expected to continue indefinitely," said Terry, at a meeting of the National Federation of Financial Analysts Societies in New York recently. "But it is not through by any means. More gas will be discovered, and more pipe lines will be built. The rate of growth will no doubt slacken gradually, but the future potentialities are of a large order."

The increase in supply of natural gas available to the industry will support a considerable further expansion of the markets, in Terry's opinion. Most of the competitive forces which have caused the rapid growth of the gas industry will continue to be effective, he said.

The field price of natural gas, however, is rising slowly, stated Terry, and in the course of years it will rise substantially, and this will reduce the competitive advantage of gas.

A gradual increase of 10 or 15 cents in the cost of natural gas will not greatly affect sales to residential consumers, now accounting for 57 percent of total revenues of the gas utility companies, in the opinion of Terry.

The use of natural gas for space heating offers a large potential market for expanding sales at good prices for many years, he stated. This market has been and will continue to be advanced by the increase in the standard of living.

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

High Gasoline Output Hurts Outlook

TOO MUCH GASOLINE was manufactured by U. S. refiners during the past month. Consequently, the industry's economic outlook is not as good as it was a month ago.

The situation requires that extreme caution be exercised during the next few months by refiners. Excessive gasoline yields cannot be continued without creating excessive inventories. Market weaknesses will develop if stocks of motor fuel are permitted to become burdensome.

Gasoline, however, is the industry's only worry. Distillate stocks have been reduced until they now are below 1953 levels. Crude stocks have been increasing lately, but are not excessive and will show improvement in May with Texas' allowable reduced from April rates.

•

THE TROUBLE the past month was that refinery yields were adjusted to manufacture an excessive amount of gasoline. Crude runs to stills during the four weeks ended April 17 were practically the same as in the corresponding period of 1953, and therefore at favorable volumes. However, 3¾ million more barrels of gasoline were made during the four weeks than manufactured during the corresponding period last year.

The high volume of gasoline produced resulted in relatively little change taking place in motor fuel inventories. Although April represents the start of the motoring season, less than 1½ million barrels of gasoline were withdrawn from storage during the four weeks ended April 17. In contrast, these inventories dropped 6¼ million barrels in the corresponding period of 1953.

Consequently, gasoline stocks of 179 million barrels on April 17 were 22¼ million barrels greater than a year ago. In mid-March, inventories of motor fuel had been only 16 million barrels above year ago levels, indicating an improved position. Consequently, gasoline stocks in mid-April had practically the same relationship with the previous year as existed at the beginning of 1954, when they were 23 million barrels above 12 months before.

Gasoline stocks will decline from now on as car travel steps up, but the question is whether they will be reduced fast enough before the end of the motoring season next November. They won't, if refiners continue to maintain gasoline yields at excessive levels.

•

MUCH OF THE GROWTH over year ago inventories which occurred the past month took place in the area east of California. This was most disturbing, as a month ago the situation outside of California looked encouraging.

Gasoline stocks east of California on April 17 were 18⅓ million barrels larger than on the corresponding date of 1953. Just one month ago, they were only 10⅓ million barrels higher than the previous year. Whereas a month ago only 65 percent of the nation's increase in gasoline inventories was east of California, in mid-April more than 80 percent of the gasoline was in this territory.

•

OTHER STOCKS are in good shape. The distillate fuel oil situation has continued to improve in recent weeks. While refiners were increasing the yield of motor fuel over year ago levels, they were manufacturing practically the same amount of distillate oil.

Consequently, distillate fuel stocks on April 21 were only 57 million barrels, nearly 4½ million barrels under a year ago. A month before they were 3 million barrels larger than in the preceding year. Distillate inventories in the area east of California were 5 million barrels below the corresponding date in 1953.

The outlook for crude also is better. May production will be under April level, with Texas' permissible output reduced by 193,000 barrels daily. This will stop the upward climb in crude inventories, which reached 265 million barrels on April 17. The latter was 2 million higher than a month ago, and practically the same as at the end of February. However, even the more recent crude stock level is considerably under the 289⅔ million barrels in tanks at the end of last September.

With distillate and crude stocks in good shape, gasoline remains the industry's only troublesome economic sore. Action of refiners in manufacturing too much motor fuel during the past month was unfortunate, but by exercising caution during the next several months, yields of gasoline can be held at levels which will permit excessive quantities to be drained off. On the other hand, too much gasoline will bring economic problems to the industry.

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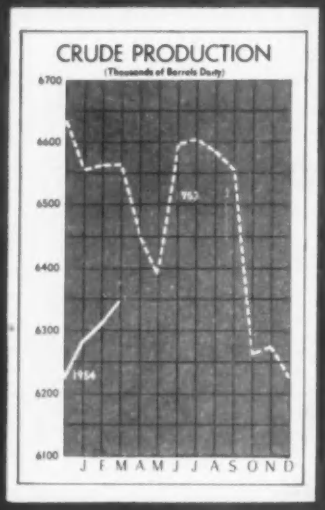
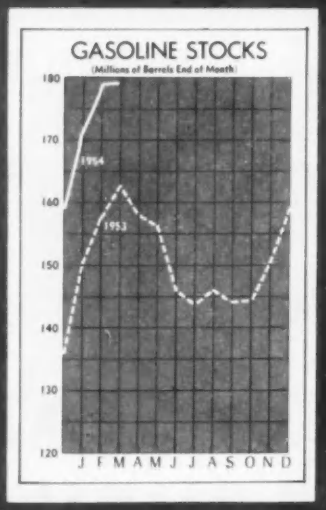
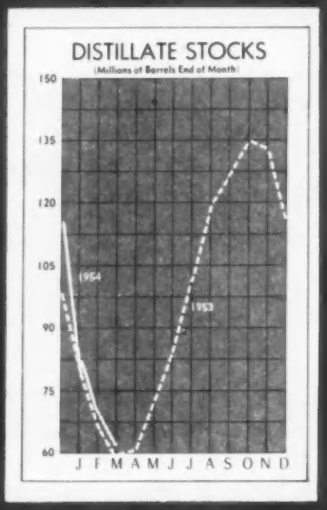
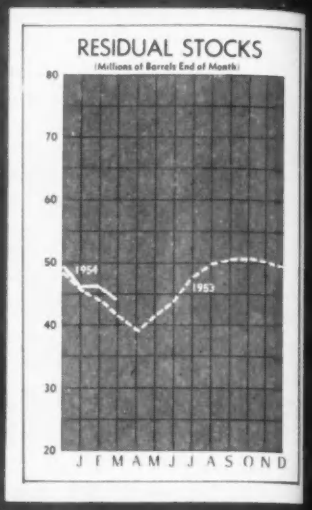
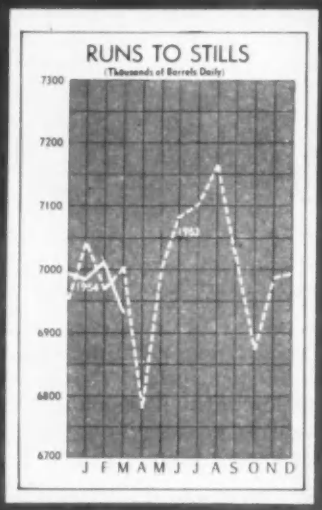
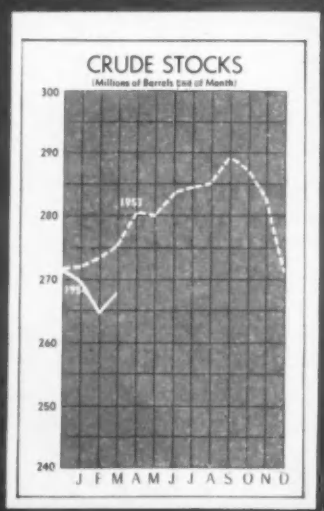












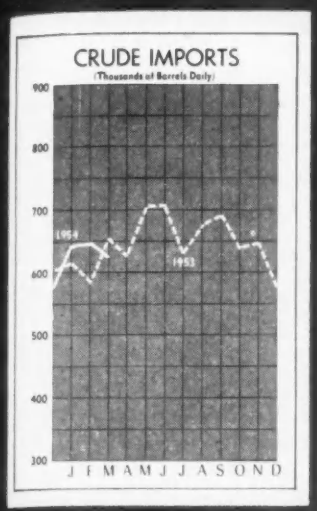
Petroleum Trends in the U. S. . . .

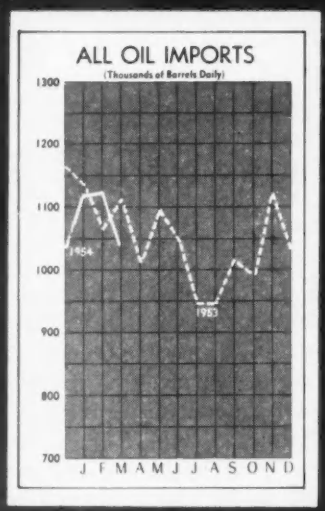
Crude production at six-month high . . .

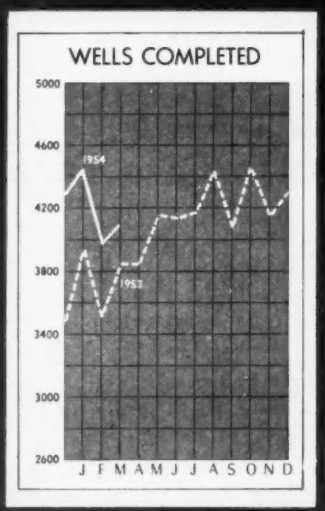
U. S. Crude Production by States

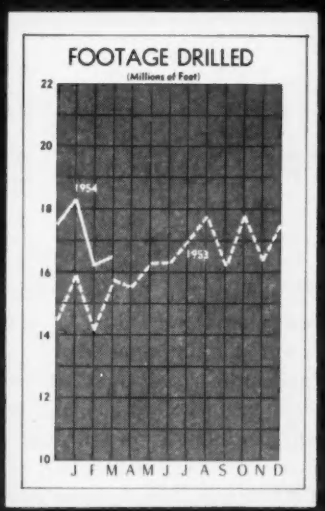
(Thousands of Barrels)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION FIRST THREE MONTHS		
	March, 1954	February, 1954	March, 1953	% Diff. March, '53-'54	1954	1953	% Diff. '53-'54
Alabama	4.3	4.3	4.4	— 2.3	396	412	— 3.9
Arkansas	75.3	75.6	77.3	— 2.6	6,907	7,307	— 5.5
California	990.6	997.9	988.9	+ 0.2	89,646	89,339	+ 0.3
Colorado	118.1	114.0	89.9	+31.4	9,590	7,319	+ 31.0
Florida	1.5	1.5	1.5		134	133	+ 0.8
Illinois	174.9	174.5	165.6	+ 5.6	15,470	14,443	+ 7.1
Indiana	30.4	31.6	34.1	—10.9	2,836	3,233	— 12.3
Kansas	325.1	318.8	333.2	— 2.4	28,441	30,276	— 6.1
Kentucky	34.5	33.9	29.6	+16.6	3,086	2,732	+ 13.0
Louisiana	643.4	672.1	669.8	— 4.0	61,822	63,917	— 3.3
North Louisiana	106.9	110.3	113.6	— 5.9	10,016	10,666	— 6.1
South Louisiana	536.5	561.8	556.2	— 3.6	51,806	53,251	— 2.7
Michigan	35.3	34.0	33.8	+ 4.4	3,061	3,061	
Mississippi	88.6	92.6	92.2	— 3.9	8,369	8,991	— 6.9
Missouri					6	6	
Montana	34.3	32.9	31.1	+10.3	2,872	2,649	+ 8.4
Nebraska	19.0	18.7	12.6	+50.8	1,692	1,353	+ 25.1
New Mexico	203.5	202.4	178.1	+14.3	18,202	16,429	+ 10.8
New York	11.7	11.7	12.8	— 8.6	962	972	— 1.0
North Dakota	14.4	15.7	15.0	— 4.0	1,343	1,350	— 0.5
Ohio	10.5	10.9	9.4	+11.7	932	800	+ 16.5
Oklahoma	516.5	520.7	542.7	— 4.8	46,767	50,106	— 6.7
Pennsylvania	24.3	24.6	28.5	—14.7	2,277	2,645	— 13.9
South Dakota					4		
Tennessee					4	3	+ 33.3
Texas	2,730.6	2,666.4	2,783.8	— 1.9	242,216	261,635	— 7.4
Dist. 1—South Central	43.3	40.4	36.7	+18.0	3,724	3,332	+ 11.8
Dist. 2—Middle Gulf	144.3	142.4	151.3	— 4.6	13,088	14,749	— 11.3
Dist. 3—Upper Gulf	424.9	439.0	457.8	— 7.2	39,922	44,385	— 10.1
Dist. 4—Lower Gulf-S. W.	253.5	245.9	253.7	— 0.1	22,579	23,708	— 4.8
Dist. 5—East Central	47.4	38.9	48.4	— 2.1	3,942	4,619	— 14.7
Dist. 6—Northeast	359.1	341.4	369.9	— 2.9	31,662	34,810	— 9.1
Dist. 7-B—North Central	135.3	125.4	104.8	+29.1	11,474	9,852	+ 16.5
Dist. 7-C—West Central	176.1	179.5	174.7	+ 0.8	16,122	15,992	+ 0.8
Dist. 8—West	869.8	847.2	927.2	— 6.2	76,751	85,571	— 10.3
Dist. 9—North	191.9	185.6	186.6	+ 3.4	16,892	16,911	— 0.1
Dist. 10—Panhandle	85.0	80.7	72.7	+16.9	7,333	6,858	+ 6.9
Utah	5.1	4.9	5.2	— 1.9	440	474	— 7.2
Virginia	0.1	0.1	0.1		7	2	+250.0
West Virginia	8.4	8.6	7.0	+12.0	766	631	+ 21.4
Wyoming	248.6	241.4	208.8	+19.1	22,024	19,190	+ 14.8
Total United States	6,349.1	6,309.8	6,335.4	— 0.1	570,272	589,408	— 3.3









By CECIL W. SMITH, WORLD OIL Staff

Oil imports at five-month low . . .

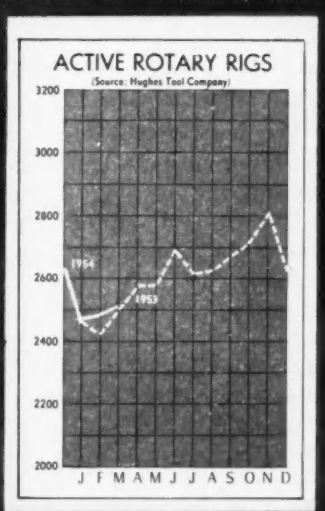
. . . Gasoline stocks at record level

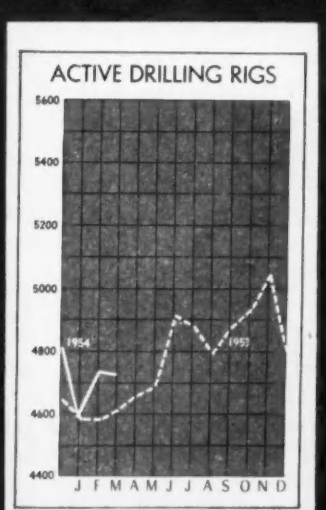
Crude Oil and Refined Products Trends

(Thousands of Barrels)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:											
February	6,367	6,673	255,900	3,109	151,912	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	1,400	48,750	1,274	37,971	510	947
April	6,429	6,435	270,679	2,995	151,890	1,312	51,634	1,253	38,561	539	922
May	5,107	4,905	290,813	2,295	123,656	982	51,648	979	38,821	545	951
June	6,197	6,825	285,964	3,169	120,166	1,455	65,911	1,228	45,688	581	911
July	6,093	6,927	275,951	3,295	116,566	1,475	85,775	1,237	52,245	597	892
August	6,219	7,118	264,368	3,377	118,592	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	1,502	117,252	1,230	56,200	615	932
October	6,518	6,883	269,776	3,301	120,062	1,458	120,721	1,203	53,052	643	1,037
November	6,487	7,049	267,852	3,416	129,509	1,510	116,096	1,299	53,069	624	984
December	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January	6,555	7,042	272,250	3,384	150,518	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	1,505	67,167	1,275	44,178	586	1,066
March	6,531	7,002	275,665	3,319	162,731	1,489	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,282	158,032	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,310	7,016	263,929	3,493	179,175	1,550	69,002	1,232	45,959	643	1,158
March	6,349	6,936	267,859	3,376	179,225	1,490	60,024	1,185	43,879	621	1,044
March, 1954: Change:											
In Month	+39	−80	+3,930	−117	+50	−60	−8,978	−47	−2,080	−22	−114
In Year	−182	−66	−7,806	+57	+16,494	+1	+222	−71	+2,279	−34	−68
Week Ended:											
4-17-54	6,590	6,915	265,196	3,371	178,923	1,412	57,034	1,208	43,256	353	745
4-18-53	6,281	6,686	276,691	3,248	157,942	1,366	61,738	1,243	39,855	569	933

Source: Data for last two months from API: prior monthly data from Bureau of Mines.





FPC Ruling in Eastern Case Encourages Natural Gas Industry

Encouraging to the natural gas industry was the ruling of the Federal Power Commission April 15 in the Panhandle Eastern Pipe Line Company case. A majority of the commission decided to permit the company to use a "fair field" price as the cost of its own gas production in determining its rate base.

Previously, the commission had followed the policy of requiring gas companies to figure their own gas at depreciated original cost for rate making purposes, limiting the companies to profits of about six percent on such depreciated cost.

The new policy is intended by FPC to encourage pipe line companies to develop gas reserves and production of their own. Heretofore, some individual members of the commission have declared that it is in the long range interest of the consumer for an interstate pipe line company to have some gas production of its own in order to achieve greater flexibility of operations, more reserves for meeting peak loads, better bargaining position in purchasing gas from others, and various other economics and advantages.

In anticipation of criticism from consumers, FPC stated that in the case of the Panhandle Eastern company, the new policy would result in an increase in the cost of gas to the average residential consumer in Detroit, at terminus of the pipe line, of only 24.3 cents per month.

The decision has the effect of allowing Panhandle Eastern an increase in revenue of $12.7 million annually, beginning May 1. The company had requested increases amounting to $21.4 million.

The decision had an immediate repercussion in Congress. In the Senate a Commerce subcommittee will hold hearings May 6 and 7 on the Ferguson bill (S-3178) to prohibit a "fair field price" for natural gas produced by interstate pipe line companies. The author of the bill is a Republican from Michigan. It was introduced in March, apparently in recognition of the Panhandle Eastern case. Similiar legislation has been sponsored in the House by Representative Oakman (R-Mich.), but in late April, hearings on his bill had not been scheduled.

A start toward alleviating the hitherto discouraging restrictions on the natural gas industry was made when Congress enacted and sent to the White House at mid-March a bill making clear that gas distributing companies operating entirely within the borders of a single state and regulated by the state are not subject to federal regulation.

In January, 1950, the U. S. Supreme Court had decided that East Ohio Gas Company, subsidiary of Consolidated Natural Gas Company, though buying gas at the Ohio border and distributing it in the state, was not a local distributor but a high-pressure system and subject to Federal Power Commission regulation.

Middle East's Role Is Spotlighted

Recent developments have emphasized the importance of the role that the Middle East will play in the world markets for petroleum. Drilling in the Middle East during the past year has revealed immense new reserves—through only a comparatively few wells. And crude from that region is so urgently seeking markets that it has succeeded in recent months in entering the U. S. at Houston, adjacent to Gulf Coast oil fields.

This crude, produced by a group of American independents in the Neutral Zone, between Kuwait and Saudi Arabia, has been priced low enough to be laid down, under present low tanker rates, on the Gulf Coast in successful competition with West Texas and other domestic crudes, having been bought by an independent refining company.

In connection with reserves in the Middle East, the spotlight is playing especially on Saudi Arabia, which now surpasses the U. S. as the No. 1 country of the world in known crude reserves. U. S. crude reserves at the end of 1953 totaled almost 29 billion barrels, the recently issued American Petroleum Institute annual estimates showed (World Oil, April 1954, Pages 48 and 49). For the same date Saudi Arabia was estimated by private sources to have a minimum of 30 billion barrels of proved crude reserves (World Oil, February 15, 1954, Page 218). Some sources emphasized that the 30 billion-barrel figure was the least that should be used and said that a higher estimate could be well supported, as the limits of established producing areas are not defined.

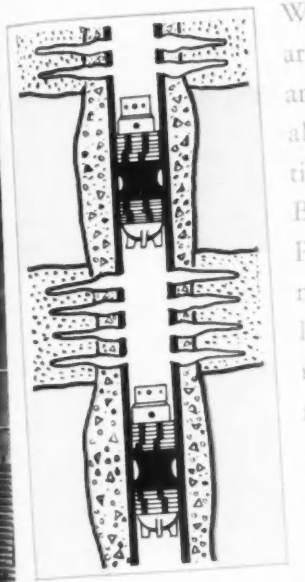
The Middle East at the end of 1953 had estimated reserves of 79 billion barrels—nearly three times those of the U. S. and representing 58 percent of the world reserves of 137 billion barrels (World Oil, February 15, Page 218). The U. S. share of the world total was 21 percent.

The most significant development in connection with world reserves lately occurred in Saudi Arabia, where there was a major discovery in early December, 1953, apparently proving up many square miles as a part of the enormous Ghawar field. Arabian American Oil Company completed its wildcat in the Huiya area as a producer. The well conclusively extended the Uthmaniyah area of the Ghawar field 15 miles southward and indicated that the same reservoir would continue on southward for 25 or 30 miles more to connect up with the extensive Ain Haradh producing area, which in turn would thereby be found to represent the southernmost part of the same huge reservoir. The great field starts on the north at Ain Dar, extends southerly 50 miles to Uthmaniyah and now 22 miles farther south to Huiya.

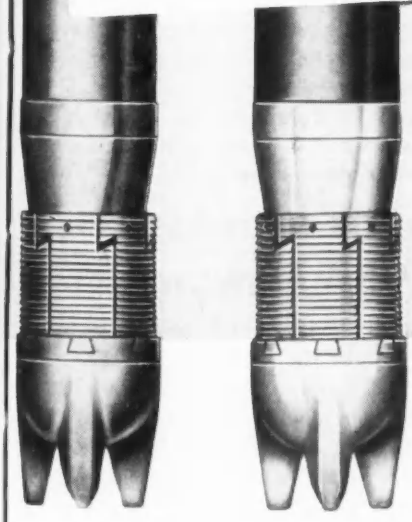
The field is therefore 72 miles long and undoubtedly the largest reservoir of oil in the world. If it extends on southward to connect up with the Ain Haradh area, as expected, it will run on for 58 miles more, making a

Something to tack up and remember!

How to save many hours in rigtime when testing multiple zones:



When several zones are to be perforated and tested individually, the combination of Lane-Wells Bridging Plugs and Perforating equipment gives extremely quick and efficient results. The usual method is to perforate and test the lowest zone, set a plug above and repeat the process for each zone above. After testing, the plugs may be drilled out or knocked to bottom after the zone above has been tested. As many as 18 separate zones in a single well have been tested in this manner.



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All across the oil country, operators report that Lane-Wells Drillable Wireline Bridging Plugs are the most satisfactory answer to down-hole operations, ranging from abandonment to casing recovery.

That's because operators have proved, for themselves, that these plugs run fast through fluid (due to greater clearance), set tight and hold against pressures either up or down (due to the big interlocking slips), and give leakproof packoff (the extra-long sealing element!) *Magnesium plugs* are rated to 6,000 p.s.i. and drill out in 1 to 3 hours; *cast iron plugs* are rated to 10,000 p.s.i. and drill out in 4 to 6 hours.

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AU-7

total length of 130 miles from north to south. That is two degrees of latitude, from 26 to 24. The field is 15 to 20 miles wide, from west to east. The oil zone in the producing formation is somewhat over 100 feet thick. The Ghawar field alone, without the other fields of Saudi Arabia, possibly will prove to have reserves exceeding those of all the thousands of fields in the U. S.

As large a reserve as it is, Ghawar has at least one worthy rival. The great Burgan field of Kuwait previously was the world's richest oil reservoir. It embraces much less area than Ghawar, but has approximately 1000 feet of oil pay sand. Burgan's reserves together with those of Kuwait's other field, Magwa, are estimated conservatively at 20 billion barrels, and some sources estimate Kuwait's reserves at 22 to 25 billions.

Saudi Arabia now has seven major fields. Abqaiq, 30 miles east of Ain Dar, the northernmost producing area of Ghawar, was Saudi Arabia's first outstanding field. Though overshadowed by Ghawar, Abqaiq itself is a remarkable field, comparable with the East Texas field in area and ultimate reserves. It is 30 miles long and six miles wide and has estimated reserves of 6 billion barrels. East Texas is 45 miles long from south to north; varies from 4 to 8 miles wide, from east to west; and is expected to produce ultimately about 5 billion barrels, of which 3 billion already has been recovered.

In January of this year, production in Saudi Arabia averaged 934,700 barrels daily fom 137 wells, an average of 6,823 barrels daily per well. The country's output is expected to go soon above 1 million barrels a day. With less reserves than Saudi Arabia, the U. S is producing about 6.5 million barrels daily from 500,000 oil wells, an average of 13 barrels daily per well. Of the U. S. production, some comes from depths of 12,000 feet or more, being therefore high-cost oil. Some has to go hundreds of miles by pipe line to reach markets, whereas much of the Middle East oil is adjacent to tidewater. In the U. S., operators are obliged to drill increasingly large numbers of dry holes and to go to greater depths to develop enough production, and now they are going out into the ocean to develop fields along the continental shelf, at costs several times those of land operations.

Look at the Middle East, and consider the U. S. scene. In the Middle East, discoveries and production now come easily. In the U. S. they come the hard way.

These are among the most significant of all facts in the economics of the world petroleum industry today.

The U. S. is importing over a million barrels of crude and refined oils per day, and Middle East crude is underselling Texas crude in the Houston refining district.

Producers of domestic crude face the necessity of achieving maximum efficiency and holding down costs to a minimum in order to meet the competition of oils from the Middle East.

Texas Cut Reflects Production Fears

Danger of overproduction of crude was recognized by the Texas Railroad Commission in cutting the state's allowable to 2,903,341 barrels daily for May.

That was 192,915 barrels a day less than the allowable prevailing April 10. The reduction canceled three-fourths of the increases granted in March and April. Texas fields in general will be allowed to produce 17 days in May. Exceptions include 16 days for Pantex, 15 days for Kelly Snyder, 13 for Sandusky, and 9 for Pickton.

The 17-day schedule was recommended by all purchasing companies except Sun Oil Company, which wanted 19 producing days, and Gulf Oil Corporation and Sinclair Oil Corporation, which favored 18 producing days.

It was brought out at the hearing at Austin on April 15, preceding issuance of the May proration order, that on April 3 U. S. crude stocks were up 6,613,000 barrels from four weeks previously, with stocks of Texas origin crude 5,346,000 barrels higher. Gasoline stocks were reported at 179,600,000 barrels, or 18,770,000 barrels higher than a year before.

Turn Off Spigot, Thompson Urges

One of the oil industry's major problems today is that refiners have forgotten why they built so much new refining capacity, according to Lt. Gen. E. O. Thompson, chairman of the Texas Railroad Commission. General Thompson was one of the principal speakers recently at the 24th annual meeting of the North Texas Oil and Gas Association in Wichita Falls, Texas.

General Thompson pointed out that the refining industry was asked to build a reserve of a million barrel daily capacity as a national defense measure and was given the privilege of writing off the amortization for tax purposes in five years.

"Of course, as soon as these new facilities were built the refiners put them on stream to see if they would work properly—but they forgot to shut them off," Thompson said.

He urged refiners to remember that this new capacity was intended to be held in standby condition for a national emergency, just as producers are carrying a million barrel daily crude reserve capacity.

Because all these new facilities are now being operated, Thompson said, gasoline stocks are excessive and far above what is needed to take care of the forecast increase in demand this year. Crude stocks are now down to proper working levels and crude production can be maintained at approximately the rate of demand, but Thompson warned that the industry is facing trouble unless refiners stop the overproduction of gasoline.

Imports Increase In 1954 Forecast

Imports of crude oil and refined products into the U. S. during 1954 likely will average approximately 1,100,000 barrels per day, an increase of 4.6 percent over the approximately 1,053,000 barrels daily average maintained during 1953, and 14.6 percent over the 1952 import rate.

The 1954 figure, based on numerous personal calls and discussions with department heads of importing companies in the U. S., was given by W. M. Vaughey, president of the Independent Petroleum Association of

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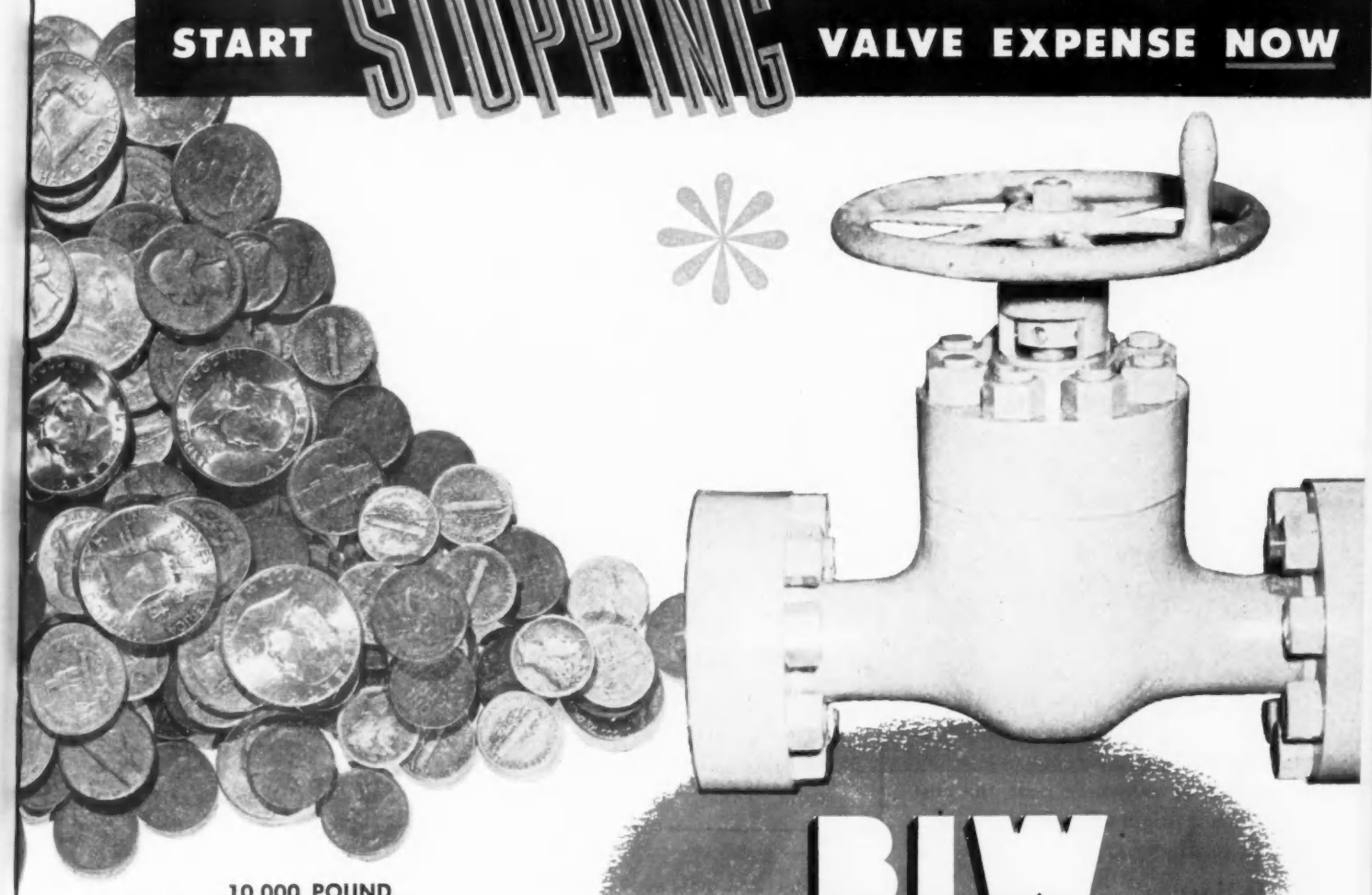

10,000 POUND WORKING PRESSURE

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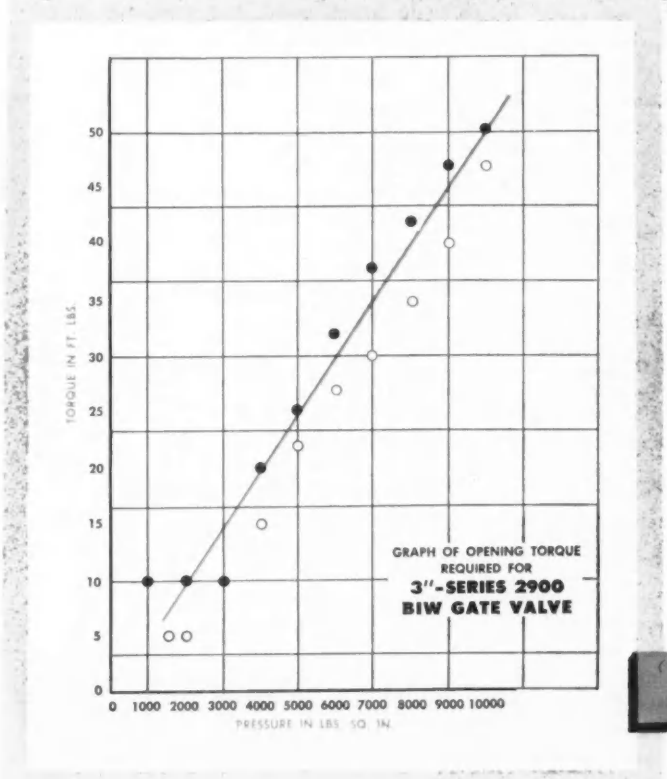

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America in an address before a special luncheon meeting of Southern California members of the Association April 8 in Los Angeles.

Vaughey said that a breakdown of his findings showed that California would experience a decrease in imports, as compared with the 1953 volume; there would be an increase of 10.2 percent in heavy crude imports east of California; an increase of 4.0 percent in lighter crudes east of California; and an increase of 9.9 percent in residual imports, most of which are brought into the eastern seaboard area.

It is entirely likely, Vaughey said, that if there is any change in these import figures, they probably will be increased slightly, rather than decreased.

Although the petroleum industry, today, is in an economically sound position, Vaughey stated, many producers in the U. S. at the present time are in a virtual state of self-liquidation; are selling oil that can't be reproduced at anywhere near the cost at which it originally was found.

The Big Moment . . .

for DAVID CROW

AN UNCLE'S advice to take a difficult road through college prepared David Crow for success in the fiercely competitive drilling industry.

The Big Moment in the career of the Shreveport contractor occurred on the eve of his university enrollment. Like many other youths of that age, David's future plans had not jelled.

David Crow

He had seen much of the country, being the son of an oil man who roughnecked, drilled, pushed tools and who later became a contractor. He grew up at Smackover, Arkansas; Corsicana, Texas; and Maud, Marshall and Oklahoma City, Oklahoma. He changed schools as often as the power of oil drew his father from place to place.

Upon graduation from high school at Oklahoma City, David tentatively set his sights on a general arts and sciences curriculum. And possibly would have found himself on another path but for an interested uncle whose advice, adroitly given, paid off handsomely.

Why not, his uncle suggested, start a petroleum engineering course? It would be easier, he reasoned, to change from a technical to general course than vice versa, should his nephew elect to shift.

To David, that figured. It was his Big Moment, and it came quietly. He began courses at the University of Oklahoma leading to an engineering degree—and didn't shift.

Taft-Hartley

Continued from Page 81

the beginning of the end of collective bargaining and free enterprise. All industry should oppose this amendment.

Q. *What are your views on the "states rights" amendment?*

A. The courts have held that the Taft-Hartley Act has "taken over" from the states the right to regulate labor relations. I think labor relations is a local, not a national, problem. The state laws should have an opportunity to work in this field. To take this position we, as employers, have to take the bad with the good because in some states the state law is better and in some states worse than Taft-Hartley. In any event, I think we should stand on the principle that a local matter like bargaining should be controlled, to the extent it needs control, by local laws. In addition to the principle involved, there are the practical aspects of this problem. If the state and local authorities can claim that even the police work in labor matters is a federal problem they won't be encouraged much to do their unpleasant duty in such cases as picket line disorder and unlawful picketing. I think we should encourage the administration to go as far as possible in the direction of getting control of labor relations, where needed, back to the local level where it belongs.

Q. *Do you think the strike ballot provision would do any good?*

A. I think I am about the last person in the U. S. who favors this amendment. I still do, though. I believe some provision is necessary to assure individual employes the opportunity to vote on the strike issue without fear of reprisal in a secret ballot. I think employes have a right to be sure that their ballots receive a fair count. I am also convinced that most strike votes taken *before* the strike starts are taken for the avowed purpose of strengthening the union's hand in bargaining. The employe who votes "yes" not only feels that he won't have to strike, but moreover has not tasted the bitterness of being without a pay check—at least not lately. So I believe there is a distinct advantage in taking the vote *after* rather than *before* the strike starts. Some people say that is locking the barn after the horse is stolen. I agree that locking the barn won't do much good, but who can object to chasing after the horse?

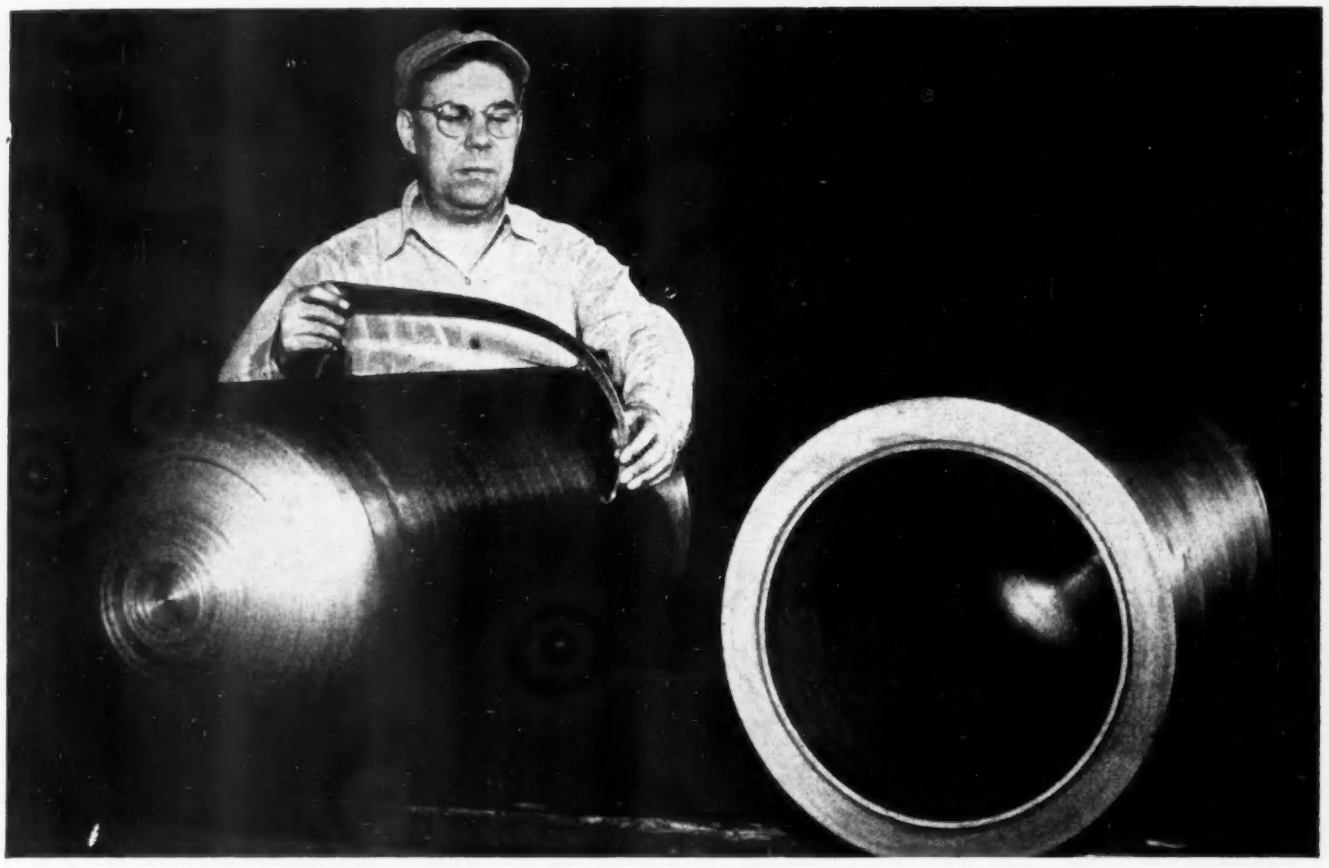
Q. *If anyone has any strong feelings about this Taft-Hartley business, what should he do?*

A. See his Senators and Congressman; write to his Senators and Congressman; telephone his Senators and Congressman; telegraph his Senators and Congressman. Do this even though you *know* your Senators and Congressman are "thinking right" on this program; do it even if you *know* that they are completely opposed to what you will advocate.

Q. *Do Senators and Congressmen pay any attention to letters, telegrams, telephone calls, and visits?*

A. They certainly do! A lawmaker's "mail" tells him what his people are thinking. He does not want to oppose those views. He loses votes if he does. A visit from a constituent either at home at recess time, or in Washington is welcomed by the lawmaker as an opportunity to hear the details of what his people think.

The author requests that it be made clear that the views expressed herein are his own, and do not necessarily reflect the opinion of his company.



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U. S. Wells Completed in March and First Three Months, 1954

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED															Rigs in Operation		
								TOTAL NEW WELLS			Total Footage March, 1954	DETAILS FOR JANUARY-MARCH						
												New Wells			Footage			
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Mar., 1954	Feb., 1954	Mar., 1953		1954	1953	Percent Diff.	1954	1953	Mar. 31, 1954	Feb. 28, 1954	Mar. 31, 1953
Alabama			1	8				9	7	6	44,267	19	25	— 24.0	100,183	134,247	8	8	6
Arizona									1			1	3	— 66.7	3,630	4,927		1	4
Arkansas	29		2	13				44	56	40	162,642	146	115	+ 27.0	489,799	412,788	31	32	26
California	152		3	44				199	250	224	858,814	677	637	+ 6.3	3,051,888	2,703,176	226	238	272
Colorado	55		5	49				109	75	38	623,528	281	125	+124.8	1,583,582	604,946	89	85	32
Florida				2				2	4	4	17,035	10	9	+ 11.1	66,621	48,255	1	2	2
Georgia				2				2		1	6,804	3	1	+200.0	11,068	4,682	1	3	3
Idaho										1			1	—100.0		12,720			1
Illinois	82		41	131				123	171	94	319,986	614	437	+ 40.5	1,582,629	1,095,524	244	217	153
Indiana	22		1	38				61	49	63	89,070	201	274	— 26.7	290,963	496,820	130	111	132
Kansas	169		41	131			3	344	311	464	1,189,375	981	1,153	— 14.9	3,398,318	3,989,899	437	440	491
Kentucky	50		17	51				118	102	87	234,057	328	229	+ 43.2	635,462	442,063	87	85	91
Louisiana	206	13	13	62				294	234	177	1,687,252	824	598	+ 37.8	5,231,246	4,169,516	257	243	240
North Louisiana	136	3	6	23				168	115	62	439,466	424	258	+ 64.3	1,223,898	931,628	58	55	50
South Louisiana	70	10	7	39				126	119	115	1,247,786	400	340	+ 17.6	4,007,348	3,237,888	199	178	190
Maryland										1			1	—100.0		4,177	3	3	4
Michigan	23		1	29				53	43	44	145,146	157	135	+ 16.3	407,116	351,969	76	94	80
Mississippi	10	2	1	21				34	30	21	221,766	85	85		559,934	624,205	36	29	27
Missouri									1			4	2	+100.0	4,533	2,186	1	1	
Montana	12			10				22	23	21	114,346	109	91	+ 19.8	436,422	438,205	27	25	49
Nebraska	10		2	12				24	31	19	136,709	92	63	+ 46.0	517,006	330,852	22	21	21
Nevada													1	—100.0		810	4	3	3
New Mexico	46		13	21		2		82	104	108	471,025	300	362	— 17.1	1,672,259	2,026,661	110	129	188
New York	30				19			49	58	69	68,191	179	216	— 17.1	249,379	300,902	82	94	98
North Dakota	16			2				18	19	23	149,455	58	60	— 3.3	395,055	476,903	32	32	28
Ohio	43		21	33				97	67	70	184,469	232	215	+ 7.9	458,331	465,235	190	193	157
Oklahoma	529	6	20	274	29		3	861	686	656	2,862,202	2,233	1,679	+ 33.0	7,608,114	6,154,965	771	729	571
Pennsylvania	30		13	4	29	5		81	114	116	139,989	299	362	— 17.4	508,849	630,623	213	255	243
South Dakota	1			5				6	2	2	30,931	10	2	+400.0	43,960	7,905	3	2	2
Texas	745	30	64	467	6		3	1,315	1,382	1,368	5,980,942	4,253	4,060	+ 4.8	19,461,125	18,621,881	1,379	1,348	1,417
Dist. 1: South Central	54	1	2	27				84	87	60	291,529	240	188	+ 27.7	804,486	564,564	39	33	41
Dist. 2: Middle Gulf	30	3	6	35				74	75	73	434,746	235	181	+ 29.8	1,404,766	1,090,265	35	37	56
Dist. 3: Upper Gulf	93	5	4	47				149	134	129	1,013,119	417	385	+ 8.3	2,862,570	2,629,771	115	118	125
Dist. 4: Lower Gulf-S.W.	55	8	7	37				107	118	142	547,408	359	486	— 26.1	1,875,456	2,815,794	94	83	115
Dist. 5: East Central	7		5	18				30	10	24	102,835	55	79	— 30.4	203,115	320,043	15	14	16
Dist. 6: Northeast	22	10	7	28				67	56	43	407,560	171	128	+ 33.6	1,068,218	749,736	59	73	44
Dist. 7-B: North Central	106		3	80	1		2	192	240	241	662,099	696	729	— 4.5	2,309,193	2,388,614	143	150	132
Dist. 7-C: West Central	39		1	24				64	99	107	337,552	305	349	— 12.6	1,481,817	1,749,225	153	148	153
Dist. 8: West	106	1	1	32				140	172	185	846,839	574	554	+ 3.6	3,545,260	3,091,766	368	358	335
Dist. 9: North	194	2	3	138	5		1	343	311	320	1,132,706	962	859	+ 12.0	3,131,064	2,867,554	254	245	322
Dist. 10: Panhandle	39		25	1				65	80	44	204,549	239	122	+ 95.9	775,180	354,549	104	89	78
Utah			1	3				4	4	11	18,673	12	24	— 50.0	70,895	151,989	16	17	16
West Virginia	3		35	13				51	30	46	148,054	118	132	— 10.6	338,475	361,875	168	183	181
Wyoming	82		2	18				102	139	53	581,427	365	140	+160.7	1,887,259	686,133	88	120	73
Total United States	2,345	51	256	1,353	83	7	9	4,104	3,993	3,827	16,486,155	12,591	11,237	+ 12.0	51,064,101	45,757,039	4,743	4,732	4,611
Total Western Canada	122		8	69				199	129	170	805,469	497	503	— 1.2	2,049,325	2,064,935	147	155	161

Completions Up 12 Percent

First quarter's 12,591 new wells a big gain over same period of 1953.

DRILLING, THROUGH the first three months of this year, continued to hold a substantial lead over operations during the comparable period of 1953. Records for the first quarter revealed that a total of 12,591 new wells was completed this year and that amounted to a gain of 12 percent over the 11,237 tests recorded in 1953's initial quarter.

Total footage drilled in those wells amounted to 51,064,101 feet this year for an increase of 11.6 percent over the 45,757,039 feet represented in last year's holes. The gain in footage drilled did not quite measure up to the hike in total wells, which indicates that the average depth of this year's wells was slightly less than their last year's counterparts. The difference, however, was very slight, as the 1954 wells were drilled to 4056 feet each on the average, while a year ago they had been taken down to 4072 feet on the average.

In three months, Texas completed 4253 wells to remain the No. 1 drilling state and almost double the next most active state. This year's Texas wells have been 4.8 percent more numerous than last year's 4060. The state's footage drilled totaled 19,461,125 to show a gain of 4.5 percent over last year's. Most of the state's districts experienced this over-all drilling gain, however, the southwestern and western areas were the exceptions.

Southwest Texas was the scene of a drilling drop of 2.5 percent from last year's 855 wells to 834. West Texas wells declined 2.7 percent from 903 to 879.

Oklahoma held tightly onto second place in the nation with a total of 2233 wells in this year's first quarter. That represented a gain of 33 percent over last year's 1679 wells. In third position was Kansas with its 981 wells representing a loss of 14.9 percent from 1953's 1153 wells.

A substantial increase in drilling amounting to 37.8 percent, occurred in Louisiana where 824 wells firmly established that state in fourth place in the nation. California, with its 677 wells showing a hike of 6.3 percent over last year's beat out Illinois' 40.5 percent gain to 614 wells for fifth ranking drilling state.

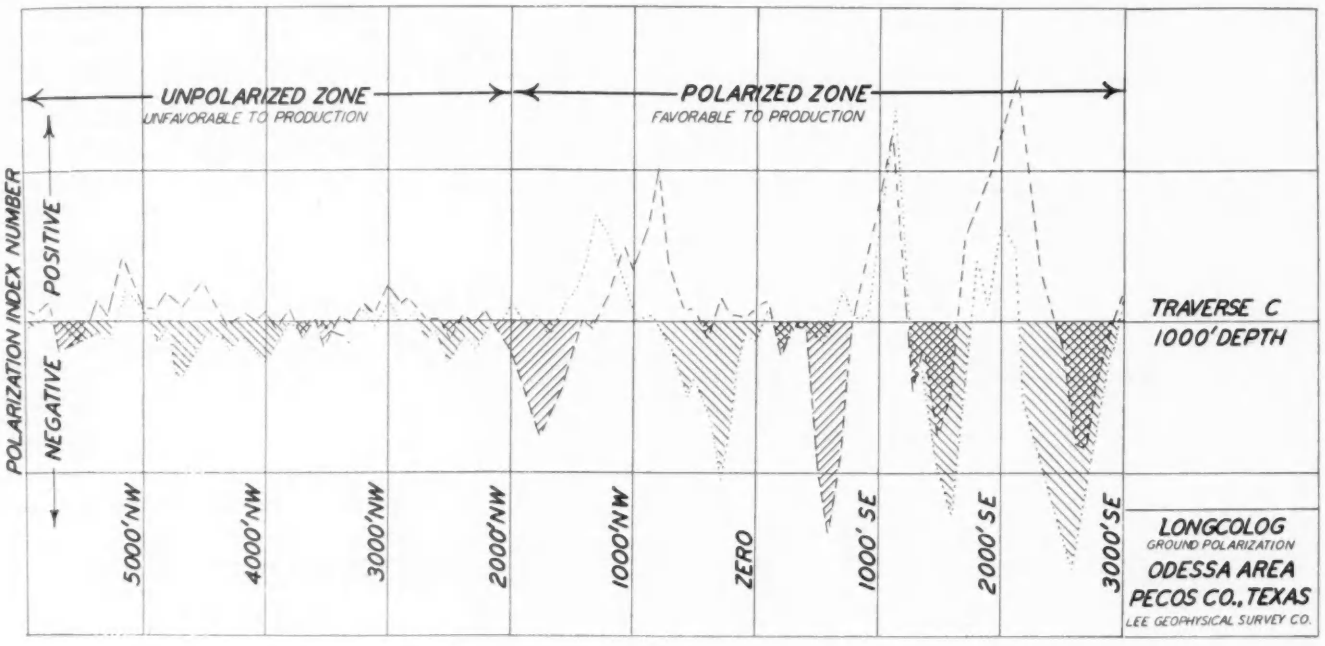

FIGURE 1.

New Oil Exploration Method Developed

Designed to aid in cutting mounting costs, it's based on principle similar to electrical well logging.

By ANTHONY GIBBON, World Oil Staff

A new method of oil exploration known as the Lee Method has been developed and field tested by Dr. Frederick W. Lee, formerly director of the geophysical division of the U. S. Bureau of Mines and the U. S. Geological Survey. Dr. Lee is president of the Lee Oil and Natural Gas Company and lives in Baltimore, Md.

The Lee Method is another exploration tool designed to aid in cutting down the mounting costs of finding new oil reserves, particularly in the Mid-Continent area. It is specially adapted in seeking stratigraphic oil deposits, particularly in oil bearing sands which are not overlain with heavy underground salt water deposits.

Based on the same set of factors as those used in electrical well logging, the method detects and measures the same electrical effects through a system of electrodes in contact with and properly distributed over the surface of the ground. After the appropriate quantities are measured the data are processed to produce "polarization index numbers" which are used in plotting polarization charts known as "Longcologs."

Longcolog Described. A Longcolog is a graph with polarization index numbers plotted on the vertical axis and distance along the line of traverse plotted on the horizontal axis. For each point on the ground there are two polarization index numbers hence the Longcolog consists of two curves, one for each set of polarization index numbers. To be significant any given feature must show the same way on both curves of the Longcolog.

By the use of Longcologs favorable prospects can be distinguished from unfavorable prospects by noting which segments of the chart show strong polarization and which show lack of polarization. Polarization is demonstrated when both curves show relatively large fluctuations above and below zero, whereas lack of polarization is indicated when the curves stay close to the zero line; that is, do not fluctuate much above or below zero.

The accompanying figures are sample Longcologs. Figure 1 covers a prospect which was worked in the Odessa area, Pecos County, Texas. The southeast portion of the traverse crossed relatively heavily polarized ground. Conversely the ground crossed by the northwest end of the traverse is remarkably free of polarization. There is now a very prolific producing oil field in the area crossed by the southeast end of this line and the edge of the field coincides closely with the change from polarized to unpolarized ground.

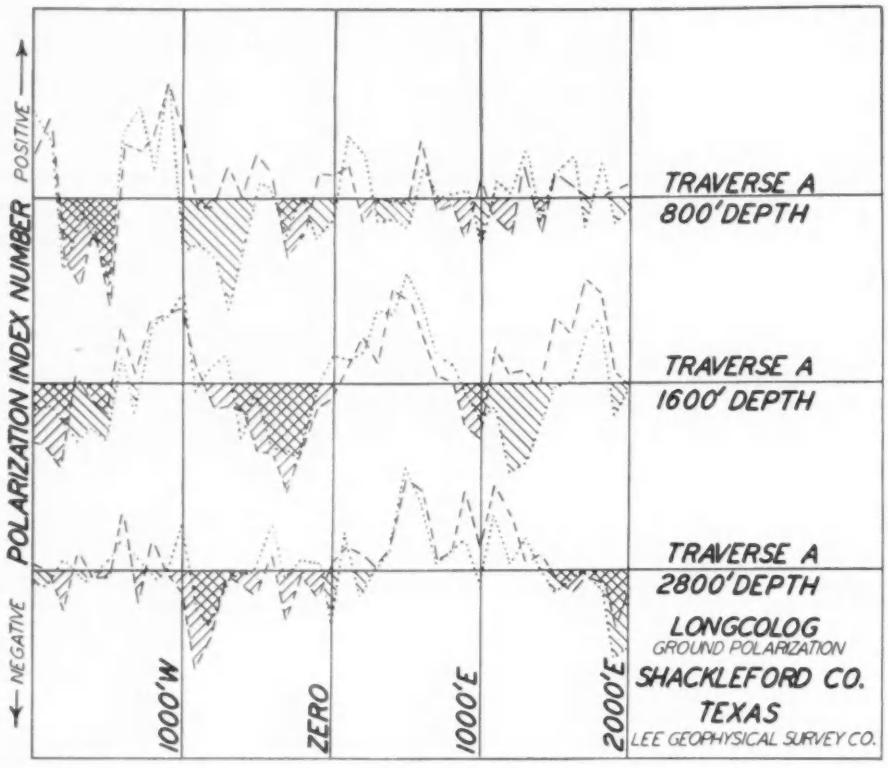

FIGURE 2.

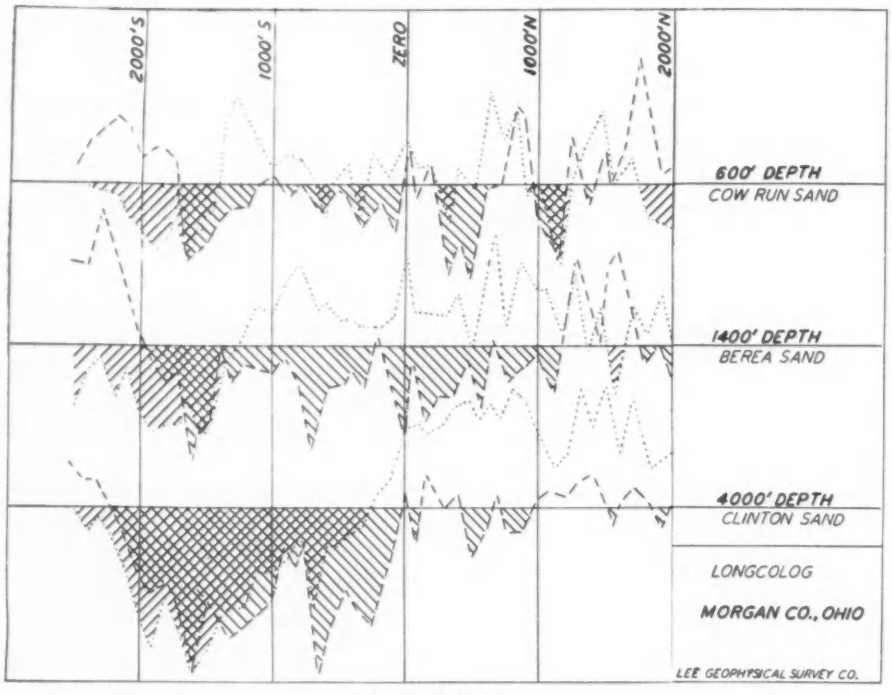

FIGURE 3.

In application of this method experience has shown that any oil or gas field of any consequence is located in an area that exhibits moderate to strong polarization and that when polarization is absent the area is probably dry.

Indicates Production Depth. It is claimed that by use of the method it is not only possible to locate potential oil fields by mapping the polarized areas, but it is also possible to pick out the approximate depth of the potentially producing horizons. This is possible because each Longcolog is drawn from values computed from a given horizon. Normally, knowledge of the geology of the area involved indicates that producing horizons may be expected within certain depth ranges. In such a case a Longcolog is computed for each of the potentially producing horizons and the potentiality of each horizon judged on the basis of the degree of polarization exhibited by the appropriate Longcolog. However, if the area is unknown, trial computations are made at several depth ranges to determine which yields the strongest polarization response.

Figure 2 illustrates the "focusing effect" resulting from computing at several depths. The data was gathered in Shackleford County, Texas, and computations were made for depths of 800 feet, 1600 feet and 2800 feet. Study of the three different sets of curves reveals that the set for 1600 feet shows the highest degree of correspondence between the two curves of the pair, especially in the interval between 1500 feet west and 1000 feet east of zero. This indicates that within this interval any oil or gas production which might be developed would probably be best at a depth between 1400 and 1800 feet.

Multiple Horizons. Where more than one producing horizon is present the fact will be manifested on the Longcologs as shown in Figures 3 and 4. Figure 3 represents results of measurements made in Morgan County, Ohio, and shows polarization present at all three horizons for which the results are shown. In that area the Cow Run sands at about 600 feet, the Berea sands at about 1400 feet, and the Clinton sands at about 4000 feet are all known to be potential producers.

Figure 4 shows the results of measurements made in Adams County, Mississippi, where the Wilcox sands extend from a depth of about 3000 feet to over 6000 feet with many possible producing horizons, and the Tuscaloosa occurs at a depth of something over 10,000 feet. Two wells, marked on the Longcolog, produce from a depth of about 5800 feet. It appears that if either well were deepened to the Tuscaloosa, substantial production would be encountered.

No Depth Limitation. Figure 4 indicates that the method can be used successfully to any practical drilling depth. This 12,000-foot Longcolog shows a definite pattern which can be

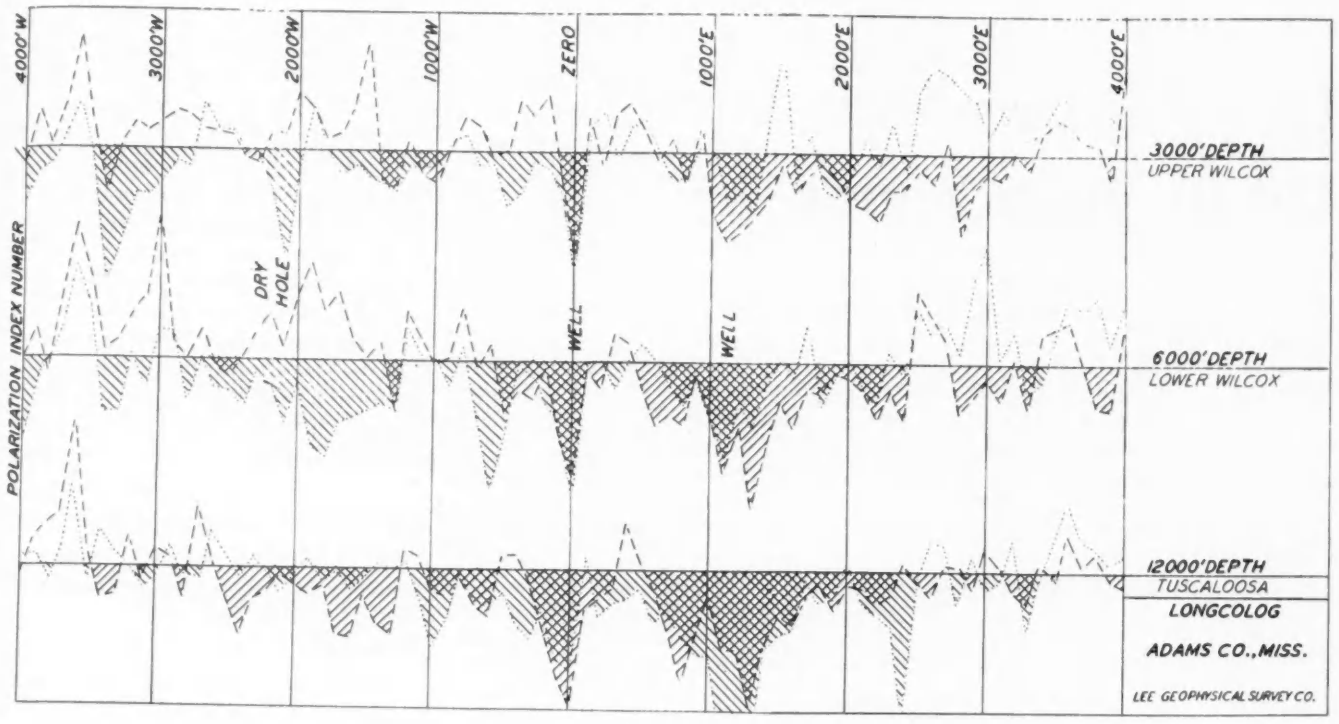

FIGURE 4.

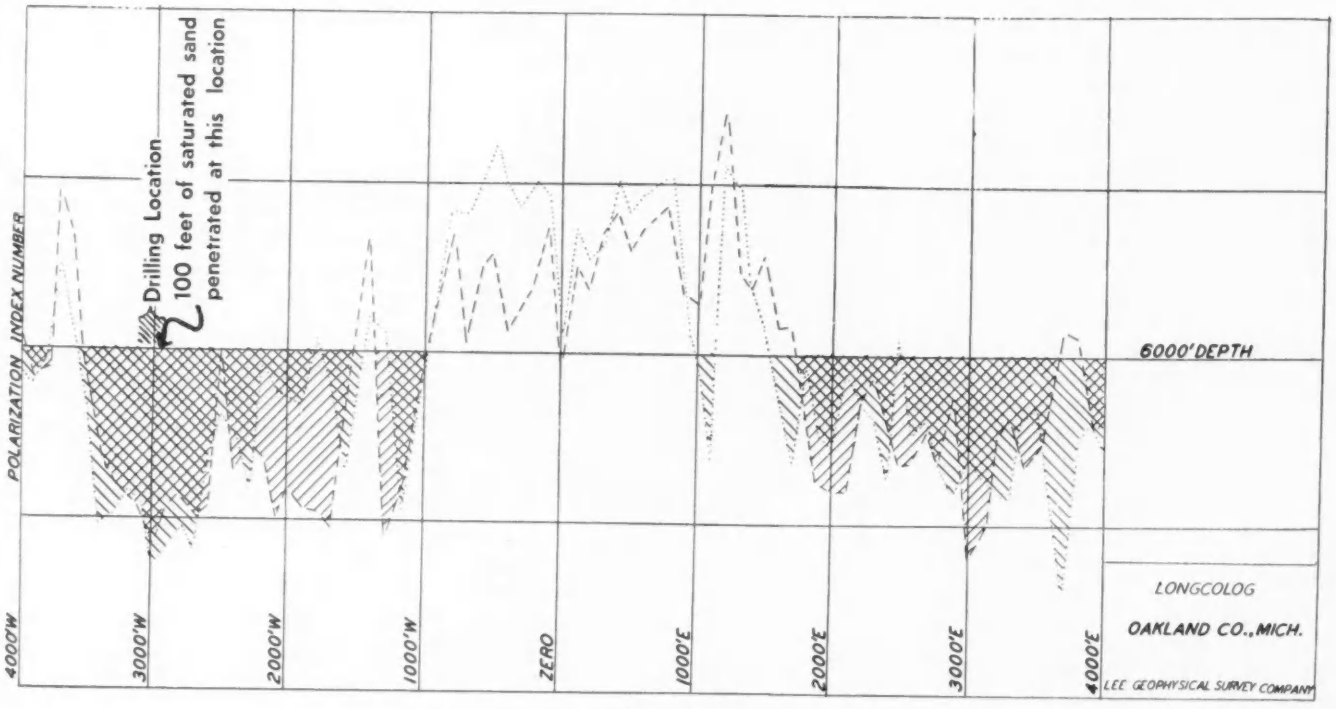

FIGURE 5.

recognized as peculiar to that depth and it can therefore be assumed that the Tuscaloosa formation at this location is petroliferous.

Figure 5 shows results of measurements made in Oakland County, Michigan, and is an example of the type of polarization encountered where large production can be expected. A well has been completed at the drilling location indicated at 3000 feet west on the Longcolog. This well encountered 100 feet of saturated sand at a depth of about 5800 feet.

Locating Wells. Although any area which is heavily polarized is generally favorable to petroleum production, it has been found that the most favorable spots within the polarized area are those characterized by negative polarization (where both curves on the Longcolog drop below zero). Therefore, once a favorable area has been outlined by mapping the polarized portion of a block, drilling locations are staked by determining the locations of the best looking "negative centers." This is usually done by first running a reconnaissance survey to outline the generally polarized zones and then making a detailed survey of selected portions of the block to determine the most favorable drilling location. —**The End**

Low Porosity May Limit Oil in Deep Sands

Sandstones buried at depths of 25,000 feet or more are subjected to high temperatures and pressures and consequently may not retain appreciable porosity and oil-containing possibilities.

By DR. JOHN C. MAXWELL and PETER VERRALL,
Department of Geology, Princeton University, Princeton, N. J.

Mechanism of Consolidation. The mechanism of consolidation of sediments (compaction and cementation) has in the past been inferred largely from thin sections and bulk density and porosity studies. Conditions of temperature and pressure and the nature and rate of movement of the solutions during lithification are unknown or at best can be estimated only within large limits. These experiments give data on behavior of sediments at controlled temperatures and pressures approximating conditions at various depths of burial, in the presence of solutions similar to those contained in many sediments at or after burial.

When a sand is buried, the weight of overburden is concentrated at the points of contact of individual grains. Compaction (decrease in volume) can occur only by failure of grains at the points of contact. Furthermore, since the areas of the points of contact are variable, failure will occur essentially at one grain contact at a time. Failure at the points of contact may occur in one of three ways:

1. Either or both grains may be strained or shattered and the shattered fragments dispersed or rotated.

2. Grains may deform by change of shape. The stronger grain may be forced into the weaker grain, as quartz into a shale fragment, or one quartz grain into another, since relative strength depends on crystallographic orientation and shape.

3. Material may be dissolved at the stressed points of contact and redeposited in unstressed or less stressed area.

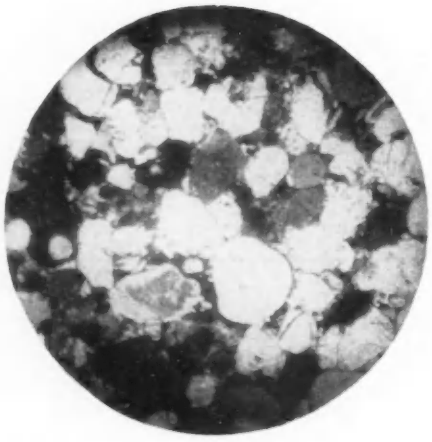

Fig. 6—Photomicrograph of thin section of an artificial sandstone, 1-7, crossed nicols X 10.

Cementation by silica likewise may be brought about in three ways (Rittenhouse[2]).

1. Introduction of silica by circulating waters long after deposition and burial of the sand.

2. Deposition of silica from sea water at or very soon after the sand was deposited.

3. Solution of silica at points of contact between grains and its redeposition in adjacent pores.

The second of these undoubtedly occurs but seems to be quantitatively unimportant in areas of thick deposits of young sediments such as the U. S. Gulf Coast. These experiments throw some light on mechanisms 1 and 3.

Thin section of our artificial sandstones reveal a quartzite-like texture (Figure 6). Compaction has occurred largely by fracturing of quartz grains, with resulting interpenetration of grains and rotation of fragments. Approximately half of the grains show strain shadows under crossed nicols, a majority of the cracked and shattered grains being so affected (Table 5). Though rarely recognizable in thin section, solution and redeposition of silica does occur. In sample IV-30, which was very firmly cemented and reduced to a porosity of 9.1 percent, thin overgrowths of quartz are visible on a few grains, quartz heals the interstices of cracked grains, and tiny terminated quartz crystals were observed projecting from the surface of a large, rounded quartz grain into otherwise open pore space.

Compaction of specimens at a "depth" of 26,500 feet results in an initial bulk density of about 1.90. (Figure 2). All points on the 7 and 100-day curves of Figure 3 lie above this value. (See Part I for Figures 2 and 3). One would suspect that these greater bulk densities were brought about by solution of silica at points of highest stress and its transfer and redeposition at points of lower stress, i.e. the oft-quoted principle of Riecke. Our results indicate the process is not quite as simple as this. In Figure 3 (Part 1), note that the sample at 270° on the 100-day curve is slightly more compacted than that at 300° on the 7-day curve, yet the former is less well cemented than the latter. Clearly in the first case a considerable degree of compaction has occurred with little solution and redeposition of silica. This conclusion is further supported by behavior of the

Part 2

7-day experiments. Above 270°, appreciable cementation of the sand occurs, i.e. silica is dissolved and reprecipitated. For the part of the curve below 240° there is no indication of solution and reprecipitation of silica, yet the degree of compaction also rises with rising temperature.

This compaction appears to be due solely to progressive shattering and reorientation of quartz grains and fragments. Thus we find two kinds of behavior with increasing temperature, both resulting in increasing compaction, but only above 270° is the compaction accompanied by appreciable cementation. Cementation seems to be largely a function of temperature. Fairbairn[1] in his work with 5 percent sodium carbonate solution found a similar temperature threshold, about 200° C., below which cementation does not occur.

Progressive mechanical failure of quartz characteristic of lower temperatures (200°-240°) indicates a progressive decrease in strength. Work by Griggs and Bell[3] gives us a clue to the mechanism involved. They found that a single quartz crystal at 400° C in the presence of 10 percent Na_2CO_3 solution at a few hundred atmospheres fluid pressure broke at about one-sixth its normal compressive strength.

Furthermore, failure in some cases was not instantaneous, but occurred after the system had been standing for some time at constant pressure. Fairbairn[1] likewise noted a marked lowering of strength of quartz and quartzite at temperatures between 150° and 315° C. with alkaline solutions at 9000 to 15,000 pounds per square inch. For a disaggregated sandstone, he found that the percent compaction was much larger with alkaline solutions (sodium carbonate and sodium silicate) than with pure water. Apparently, the strength of quartz in alkaline solutions is lowered greatly at moderate pressures and temperatures. The seawater and Cockfield formation water of those experiments are mildly alkaline.

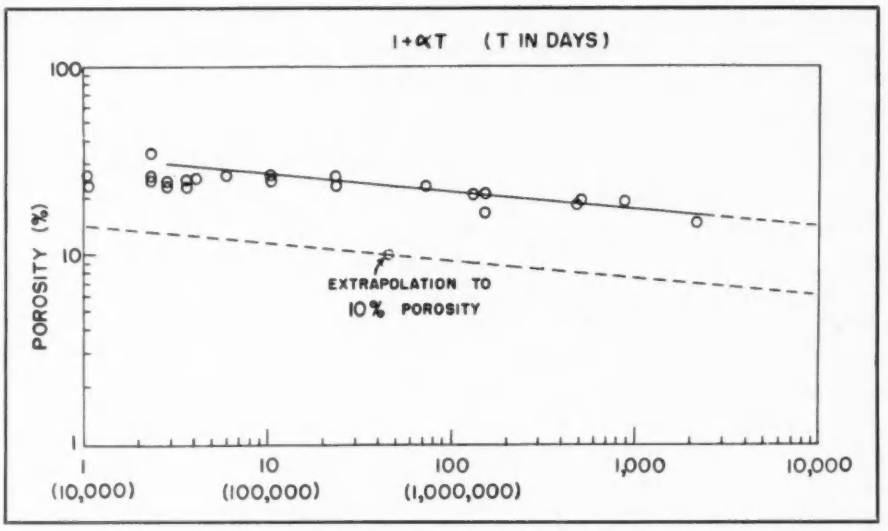

Fig. 7—Extrapolation of data at constant depth of 26,500 feet. See text for explanation.

Our data indicates a double mechanism for consolidation of a sand sample in these and similar experiments. Both compaction and cementation occur, but somewhat independently of each other. Each is aided by alkaline solutions and elevated temperatures; apparently the actual temperature may favor either one or the other process, though at higher temperatures straining and fracturing undoubtedly increasing the rate of cementation.

Many medium to coarse grained quartz sandstones show abundant evidence of filling of pore space by secondary quartz. Commonly these sandstones also show penetration of rounded quartz grains into adjacent grains, and long, straight contacts between grains. The texture is usually ascribed to the operation of Riecke's principle, i.e., solution of material from points of greatest stress and deposition in less stressed areas. This attractive hypothesis is probably an oversimplification for natural as well as artificial sandstones. In these experiments a similar pattern is produced by straining, shattering and rotation of grains with little or no redistribution of silica in solution. The phenomenon of penetration of rounded grains into adjacent grains is explicable on the basis of relative strength, but not as a solution phenomenon as under Riecke's principle, (unless it is a reflection of crystallographic orientation, not as yet demonstrated). Furthermore, there has been no convincing experimental demonstration that Riecke's principle, as generally stated, applies to the behavior of quartz. Failure and interpenetration of quartz grains is due almost entirely to rupture.

For these experiments, and perhaps for natural sandstones also, increasing depth of burial, in the presence of alkaline solutions and accompanied by increasing temperature, results in stress concentration and failure in a series of grains, the sequence depending largely on the relative areas of contact. A few cracked grains should be present in a natural sandstone at any given stage of burial beyond some shallow depth, perhaps 5000 feet. In thin sections of many sandstones such

TABLE 5
Behavior of quartz grains in compaction tests

SAMPLE	Total Counted	Percent Solid Unstrained	Percent Solid Strained	Percent Cracked Unstrained	Percent Shattered Fragments Strained	Percent Shattered Fragments Unstrained	Percent Shattered Fragments Strained	Percent Unstrained Total	Percent Strained Total
Beach sand source material.....	205 (197 quartz 5 chert 3 plagioclase)	73	27	..	..	..	..	73	27
I-3.....	138	21	8	25	28	3	15	49	51
I-7.....	137	20	6	19	30	3	22	42	58
II-1.....	155	16	5	26	32	7	14	49	51
IV-30.....	151	31	4	19	26	4	16	54	46

cracked and strained grains can be found. Both Taylor[4] and Rittenhouse[5] have observed crushed grains in natural sandstones. Cracking and straining of quartz increases its solubility. One would expect solution and reprecipitation of this material, and probably also recrystallization of strained grains.

That recrystallization does occur is perhaps indicated by Table 5. Of the four artificial sandstones listed, number IV-30 is by far the most compacted and best cemented, with observable secondary quartz growths. It has also the lowest ratio of strained to unstrained grains. The work of Griggs and Bell[3] likewise suggests annealing in the presence of alkaline solutions at high temperatures; they found strained grains in quartz deformed dry, at room temperature, but in grains deformed in 10 percent sodium carbonate solution at 400° C. no trace of undulatory extinction was observed.

Crushing, fracturing and straining of the quartz grains at points of contact are believed to be of prime importance in producing the interlocking texture of quartz-cemented sandstones, accompanied, however, by solution of the more soluble crushed and strained quartz so created and its reprecipitation elsewhere within the sandstone.

Extrapolation of Data. A majority of the experiments was carried out at a simulated "depth" of 26,500 feet, and an attempt had been made to rationalize the data for this "depth" in such a way that extrapolation to greater lengths of time would be possible. The following assumptions were made in deriving the equation:

1. Porosity after initial application of pressure, but before any time or temperature effects have occurred, is constant.

2. The rate of decrease of porosity is proportional to a function of the porosity.

3. The rate of decrease of porosity is proportional to a function of the temperature.

The arbitrary constants in the resulting equation were determined from experimental points at 270° C, 285° C, and 300° C, and the final empirical equation arrived at was:

$$(34/P)^{10.4} = 1 + e^{\frac{T-540}{.0186T}} t = 1 + \alpha t$$

where

P = Porosity in %
T = Temperature, Kelvin
t = Time in days

$$\alpha = e^{\frac{T-540}{.0186T}}$$

Points so calculated give a straight line plot (Figure 7). For values of $1 + \alpha t$ greater than approximately 6, the experimental points fit the theoretical curve well, and extrapolation would indicate, though somewhat tenuously, that at 300° C., porosity would be decreased to 10 percent in 60 years and to 5 percent in 60,000 years. At 285° C. the corresponding times are 250 years and 300,000 years and at 270° C., 1000 years and 1,000,000 years.

For values of $1 + \alpha t$ below 6, i.e. under conditions of low temperature or short time or both, the experimental points fall below the theoretical curve, that is, the samples have an unexpectedly low porosity. At present there is no satisfactory explanation for this anomalous behavior.

Conclusions. Consolidation of quartz sand to sandstone can be carried out under experimental conditions simulating deep burial. Consolidation involves compaction and cementation, both processes proceeding somewhat independently, but both aided by high temperatures and the presence of alkaline solutions.

Little or no cementation occurred in two experiments with distilled water. Seawater and water from the Cockfield formation, both mildly alkaline, were used for most of the experiments.

In mixtures of quartz sand with seawater or Cockfield formation water no appreciable cementation occurs at "depths" of 24,000 feet or less, or at temperatures below 270° C., in times up to 100 days. If cementation occurs at all, it begins quickly and is noticeable after about 24 hours. Much longer runs at lesser temperatures and depths result in no appreciable cementation. Compaction does occur below 270° C., however. Between 200° and 240° C. compaction increases with increasing temperature, but without attendant cementation. Between 240° and 270° there is an apparent slight increase in the strength of quartz and decrease in compaction, the reason for which has not been determined.

Except for the 240°-270° range, both increased time and increased temperature result in decreased porosity of the sample. The effect of Cockfield formation water is about the same as seawater even though the formation water has about twice the salinity (but nearly the same pH) as seawater.

Temperature has a very large effect on consolidation. Extrapolation of data indicate, for example, that at a "depth" of 26,500 feet, in the presence of seawater a sample at 300° C. would be reduced to 10 percent porosity in about 60 years, but the same reduction at 270° would require about 1000 years.

Experiments indicate that a pure, well sorted quartz sand, saturated with seawater or fluid of similar composition and pH, probably would not retain appreciable porosity (± 10 percent) if buried to depths of 25,000 feet or more, at temperatures above 270° C. Flowing solutions appear to accelerate the rate of cementation, i.e., a shallower limit for occurrence of appreciable porosity is suggested, but as pointed out in the paper the effect may be exaggerated by the conditions of the experiment.

Experiments now underway show that in an impure sandstone (Cockfield) the reduction of porosity is greater than in pure quartz sand under identical experimental conditions. Limiting depth for appreciable porosity in impure or poorly stored sands is probably somewhat less than that indicated for pure quartz sand.

—The End

ACKNOWLEDGEMENTS

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BIBLIOGRAPHY

[1] Fairbairn, H. W., Synthetic Quartzite, Amer. Min. v. 35, p. 735-748, 1950.
[2] Rittenhouse, Gordon, Interpretative Petrology of Sedimentary Rocks, WORLD OIL, p. 64, 1949.
[3] Griggs, David, and Bell, J. F., Experiments Bearing on the Orientation of Quartz in Deformed Rocks, Bull. Geol. Soc. America, v. 49, p. 1723-1746, 1938.
[4] Taylor, Jane M., Pore-Space Reduction in Sandstones, Bull. A.A.P.G. v. 34, p. 175, 1950.
[5] Rittenhouse, Gordon, Personal Communication.

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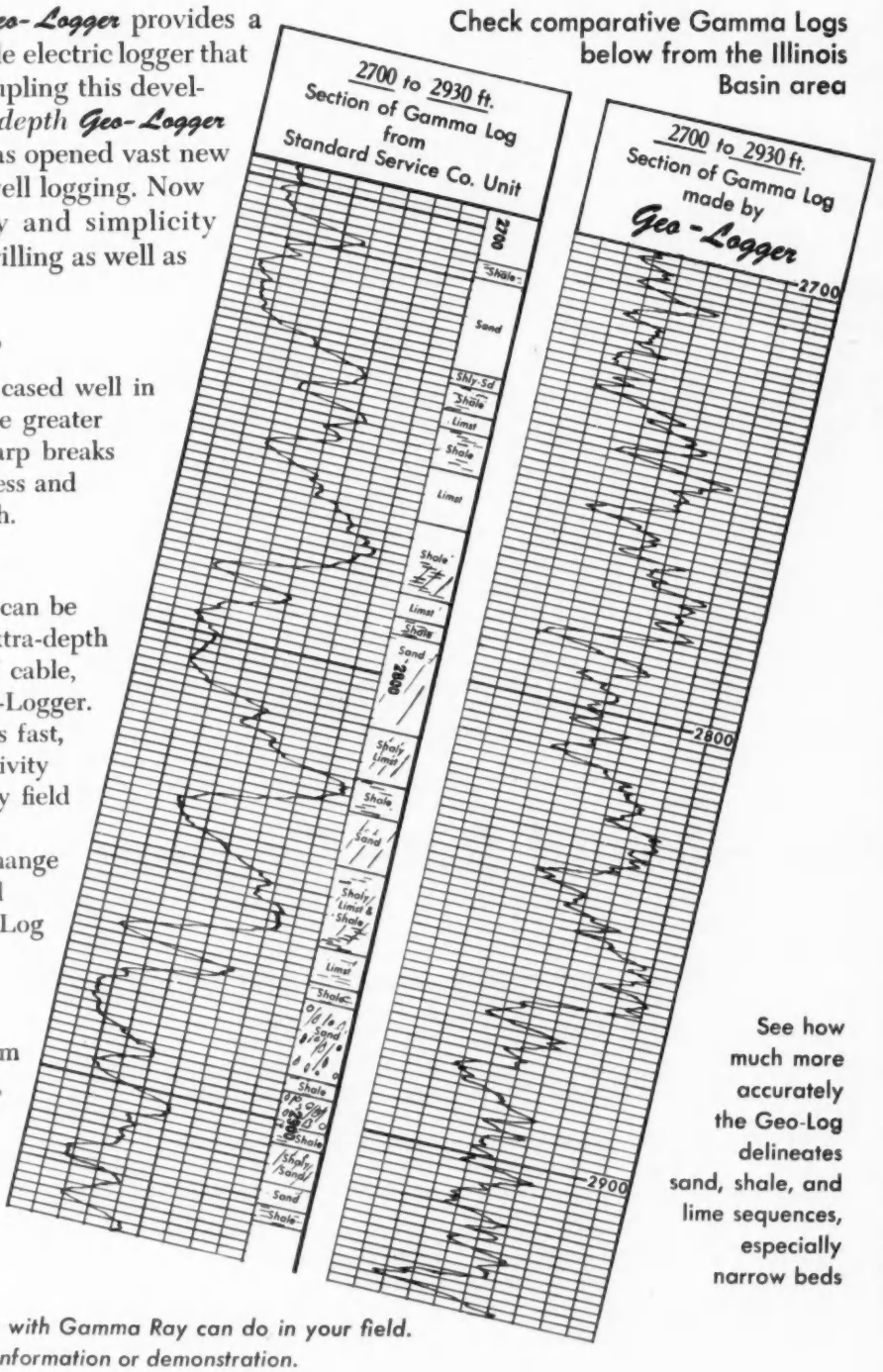

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	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests									Total Productive	Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	3 Mo. 1954	3 Mo. 1953	Wildcats	New Pays	Outposts	3 Mo. 1954	3 Mo. 1953	3 Mo. 1954	3 Mo. 1953
Alabama											8			8												15			15	16	15	16
Arizona																										1			1	3		3
Arkansas	1									1	9			10	1			1						2	10	23			23	31	25	41
California	1									1	18			19	6		2	1		1	1			11	19	82		2	84	110	95	129
Colorado	3									3	33			36	10		3						1	14	8	85		1	86	71	100	79
Florida											2			2	1									1		9			9	9	10	9
Georgia											2			2												3			3	1	3	1
Idaho																														1		1
Illinois	2			1			8			11	36			47	6			9			20			35	14	127			127	95	162	109
Indiana	1			1						2	19			21	4			1						5	8	61			61	72	66	80
Kansas	8		2	1						11	67			78	27			5	2		1		1	36	47	178			178	211	214	258
Kentucky	3									3	4			7	10									10	9	15			15	24	25	33
Louisiana		1	1	1	1	2				6	24			30	8	7	3	9	9	4		1		41	28	87			87	96	128	124
North Louisiana											9			9	1			2		2				5	3	29			29	45	34	48
South Louisiana		1	1	1	1	2				6	15			21	7	7	3	7	9	2		1		36	25	58			58	51		76
Michigan	1									1	21			22	2									2	6	70			70	53	72	59
Mississippi											16			16								1		1	9	34			34	43	35	52
Missouri																										4			4	2	4	2
Montana											4			4	1			1						2	3	26			26	19	28	22
Nebraska											8			8	5			1			1			7	4	25			25	32	33	36
Nevada																														1		1
New Mexico	1		2							3	13			16	6		6	1	1		1			15	13	53			53	39	68	52
North Dakota	1			1						2	2			4	1			1			2			4		20			20	12	24	12
Ohio																							1	1	1	1			1	8	2	9
Oklahoma	10	1	1	5		1	7			25	67			92	26	4	4	12		1	23	2	2	74	57	175			175	175	249	232
Pennsylvania																									1						1
South Dakota	1									1	1			2	1									1		5			5	2	6	2
Texas	39	1	4	16	4		6	1	2	73	273		10	356	132	14	27	57	16	2	20	3	7	278	278	929		15	944	1029	1222	1307
Dist. 1 S. Central			1				1			2	19			21	6		1		1		2		1	11	7	59		1	60	75	70	82
Dist. 2 Middle Gulf											27		1	28		3	3	1					1	8	10	61		2	63	70	71	80
Dist. 3 Upper Gulf	3	1		7	1					12	24		7	43	9	3	2	21	3	1				39	43	92		7	99	97	138	140
Dist. 4 L. Gulf-S.W.	4			2	3			1		10	24		1	35	6	4	2	9	10	1		3	1	36	50	76		2	78	122	114	172
Dist. 5 E. Central											12			12				1			1			2	3	29			29	35	31	38
Dist. 6. Northeast											12			12	1				1					2	5	34			34	36	36	41
Dist. 7-B N. Cent.	7		2	2			1		1	13	39			52	40		10	3			2		1	56	66	203			203	234	259	300
Dist. 7-C W. Cent.	4								1	15	18			23	10		4	3			1		1	19	22	86		1	87	85	106	107
Dist. 8 West	11		1	1			3			16	23		1	40	28	2	1	7	1		11			50	34	95		1	96	77	146	111
Dist. 9 North	9			4			1			14	75			89	31	1	2	12			3		1	50	37	185		1	186	198	236	235
Dist. 10 Panhandle	1									1				1	1	1	2						1	5	1	9			9		14	1
Utah											2			2	1			1						2	3	5			5	15	7	18
Wyoming	7									7	11			18	22			2	6		2			32	2	50			50	23	82	25
Total U.S.	79	3	10	26	5	3	21	1	2	150	640		10	800	270	25	54	101	26	8	71	7	12	574	520	2083		18	2101	2193	2675	2713

Near-Record Rate Continues

2675 exploratory tests in first quarter only 1.4 percent under last year's record 2713.

By CECIL W. SMITH, WORLD OIL Staff

EXPLORATORY DRILLING in the year's first quarter was only slightly under the all-time high volume carried on during the comparable period of 1953. A total of 2675 exploratory tests was drilled in the first three months to figure only 1.4 percent under the peak of 2713 tests completed a year earlier.

Although tests were slightly less this year, the important thing is that a greater number of those tests proved to be producers. A grand total of 574 wells was productive this year while a year ago the best wildcatters could do was bring in 520 producers or 10.4 percent less. So far this year, the score has been 21.5 percent productive out of the total drilled while a year earlier the count had been 19.2 percent.

This year new oil discoveries numbered 372 against 341 a year ago for a gain of 9.1 percent. Those discoveries were made up of 270 new oil fields and 102 new oil pay horizons in established fields. A year ago the count had been 247 new fields and 94 new oil pays. Oil field extensions numbered 71 in each of the two periods.

Distillate discoveries this year have numbered 51 for an increase of 59.4 percent over the 32 made in last year's first quarter. Those new finds were 25 new distillate fields against last year's 22 and 26 new distillate pays compared with 10 a year before.

Summary of Results of Exploratory Drilling

ITEM	Mar. 1954	Feb. 1954	THREE MONTHS January-March 1954	1953	Percent Diff.
Oil Discoveries	105	114	372	341	+ 9.1
New Fields	79	79	270	247	+ 9.3
New Pays	26	35	102	94	+ 8.5
Distillate Discoveries	8	24	51	32	+ 59.4
New Fields	3	12	25	22	+ 13.6
New Pays	5	12	26	10	+160.0
Gas Discoveries	13	18	61	63	— 3.2
New Fields	10	17	53	54	— 1.9
New Pays	3	1	8	9	— 1.1
Total Discoveries	126	156	484	436	+ 11.0
Extensions to Fields	24	31	90	84	+ 7.1
Oil Fields	21	22	71	71	.....
Distillate Fields	1	5	8	4	+ 75.0
Gas Fields	2	4	12	9	+ 33.3
Total Prod. Tests	150	187	574	520	+ 10.4
Dry Holes	650	644	2101	2193	— 4.2
Wildcats	640	637	2083	2157	— 3.4
New Pays	.....	.....	.....	.....	.....
Outposts	10	7	18	36	— 50.0
Total Expl'tory Tests	800	831	2675	2713	— 1.4
Percent Productive	18.8	22.5	21.5	19.2	.....
Percent Dry	81.2	77.5	78.5	80.8	.....

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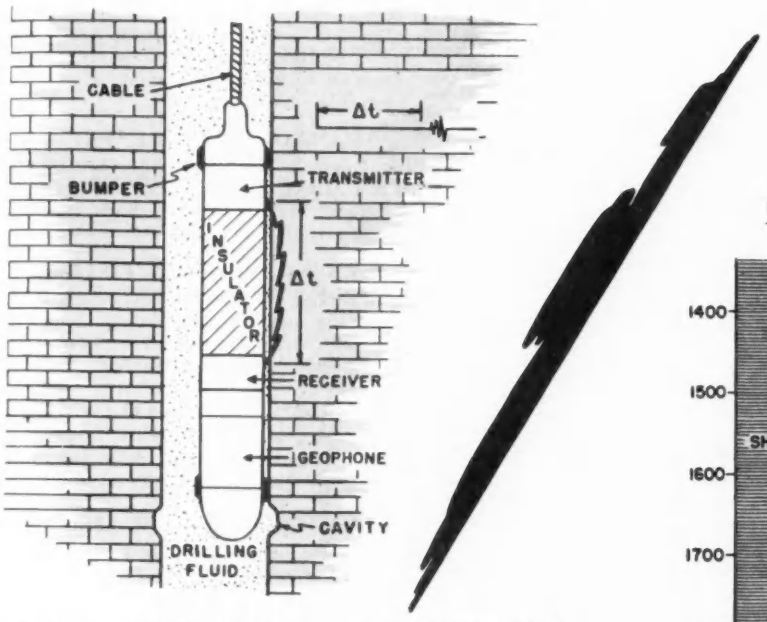

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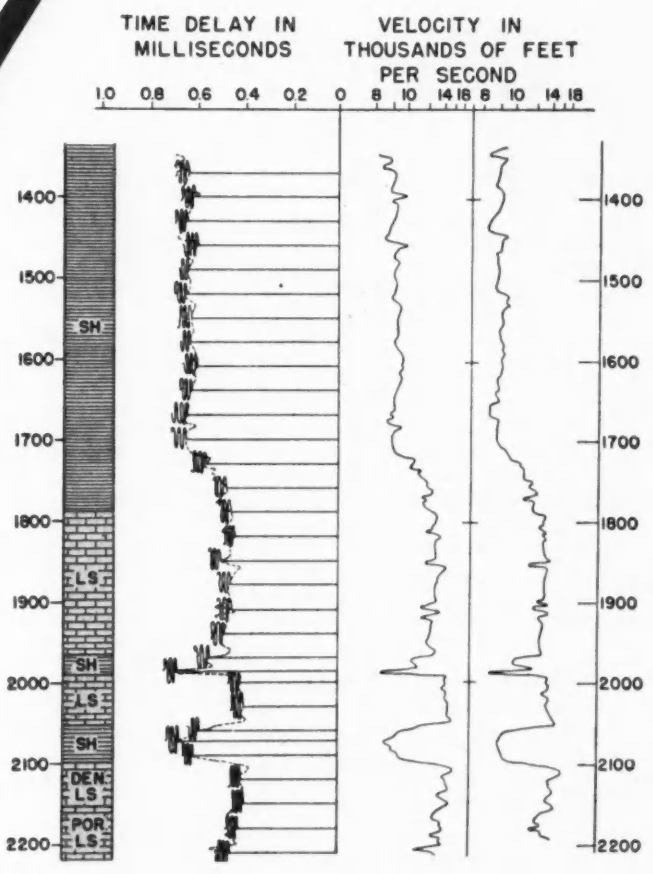
Continuous Velocity Logging is a development of Magnolia Petroleum Company's Field Research Laboratories and SSC is the licensed operator.

This new service is now available from SSC's Midland Texas District Office. For information contact SSC, Room 134 Central Building, Phone 2-1261, Midland, Texas.



Diagrammatic illustration of the variation in time delay to form a composite velocity log and the comparison of two velocity logs from different wells in the same field.

SEISMIC SURVEYS — GRAVITY SURVEYS — PILOT CREWS — LORAC — VELOCITY LOGGING

Seismograph Service Corporation

TULSA, OKLAHOMA, U.S.A.

WORLD-WIDE EXPERIENCE

U. S. Discoveries in March

NEW FIELDS, NEW PAYS AND EXTENSIONS

ARKANSAS—NEW OIL FIELD

Union County. Austral Oil Exploration Co., Inc. & Lyons, McCord & Logan's S. J. McGraw 1, C NE NE SW, 34-18s-16w, pumped 79 barrels oil and 120 barrels water from Tuscaloosa lime, Upper Cretaceous 3105-10 feet, 44-gravity, completed 2-6-54, TD 7896.

CALIFORNIA—NEW OIL FIELD

Ventura County. Lloyd Corporation, Ltd.'s W. R. Livingston 1, in 31-2n-21w, flowed 600 barrels from Von Hagen sand 9989-10,024 feet, 16/64-inch, 32-gravity, complted 3-19-54, TD 10,024.

COLORADO—NEW OIL FIELD

Logan County. McDermott & Barnhardt's D. W. Piper 1, SE NE 29-9n-53w, flowed 20 barrels from "D" sand, Upper Cretaceous 4830-56 feet, 28/64-inch, completed 3-10-54, TD 5046.

Morgan County. Petroleum Inc.'s Glenn-Brown 1, SE SE NE 35-2n-58w, pumped 85 barrels from "D" sand, Upper Cretaceous 5668-74 feet, completed 3-8-54, TD 5797.

Weld County. S. D. Johnson & Courtlandt Dietler's Spinner 1, NE NE 35-6n-61w, flowed 1200 barrels from "D" sand, Upper Cretaceous 6668-78 feet, ½-inch, completed 3-2-54, TD 6740.

ILLINOIS—NEW OIL FIELDS

Christian County, Mt. Auburn, Central field. H. F. Robison's Tankersley 1, SW SE NW 13-15n-2w, Old Well Worked Over, flowed 303 barrels from Silurian lime, Silurian 1864-85 feet, completed 3-16-54, TD 1885.

Mt. Auburn, East field. M. H. Richardson's M. Long 1, SE SE NE 8-15n-1w, pumped 138 barrels from Silurian lime, Silurian 1864-86 feet, completed 3-9-54, TD 1886.

ILLINOIS—NEW OIL PAY

Franklin County, Christopher field. National Associated Petroleum Co.'s Eickelman 1, NE SW 13-6s-1e, pumped 99 barrels from Aux Vases sand, Mississippian 2598-2618 feet, completed 3-16-54, TD 2803.

ILLINOIS—OIL FIELD EXTENSIONS

Crawford County, Main field. Affeld Oil Co.'s Cullum 1, SW SW SW 17-5n-12w, 1-mile south extension, flowed and pumped 120 barrels from Cypress sand, Mississippian 1472-82 feet, completed 3-30-54, TD 1484.

Franklin County, North City field. National Associated Petroleum Co.'s Green 1, NE NE 11 6s-1e, Old Well Worked Over, pumped 73 barrels from Aux Vases sand, Mississippian 2626-42 feet, completed 3-16-54, TD 2793.

Gallatin County, Herald Consolidated field. C. E. Brehm's M. C. Wiseheart, NE NW SE 27-7s-9e, 1-mile extension, pumped 12 barrels oil and 26 barrels water from Cypress sand, Mississippian 2596-2603 feet, completed 3-30-54, TD 2908.

Hamilton County, Thackeray field. Artnell's R. D. Nation 1, NW NW SW 9-5s-7e, 1-mile west extension, pumped 5 barrels oil and 5 barrels water from Aux Vases sand, Mississippian 3368-73 feet, completed 3-30-54, TD 3553.

Wayne County, Cisne, North field. National Associated Petroleum Co.'s Stine Consolidated 1, E½ NE NW 17-1n-7e, Old Well Worked Over, ½-mile extension, pumped 33 barrels oil and 75 barrels water from Aux Vases sand, Mississippian and McClosky lime, Mississippian, completed 3-9-54, TD 3243.

Clay City Consolidated field. Pure Oil Co.'s H. E. McLin 1, SE NW NE 32-1s-8e, ¾-mile extension, pumped 63 barrels oil and 130 barrels water from Aux Vases sand, Mississippian 3170-90 feet, completed 3-16-54, TD 3306.

White County, Concord, North field. W. H. Dickerson's M. D. Seal 1, NW NE NW 15-6s-10e, ½-mile south extension, pumped 144 barrels oil and 6 barrels water from Rosclare lime, Mississippian 3034-3043 feet, completed 3-23-54, TD 3080.

Phillipstown Consolidated field. Arrowhead's E. Sturm, NE NW NE 1-4s-10e, ¾-mile extension, pumped 5 barrels from Lower O'Hara lime, Mississippian 3114-19 feet, completed 3-30-54, TD 3247.

INDIANA—NEW OIL FIELDS

Gibson County, Union, West field. Bury Drilling Co.-Baylor & Beare's Fithian-Lynch 1, in ND 60-1s-10w, pumped 300 barrels from McClosky lime, Mississippian 1839-43 feet, completed 2-24-54, TD 1883.

INDIANA—NEW GAS FIELD

Decatur County. Westport Natural Gas Co. Inc.'s Edward Whalen, SE SE SW 9n-8e-36, flowed 0.1 million from Trenton sand, Ordovician 908-909 feet, completed 3-24-54, TD 929.

KANSAS—NEW OIL FIELDS

Rice County. Petroleum Inc.'s Malone 1-C, SW NW SW 25-20s-10w, pumped 25 barrels from Lansing lime, Pennsylvanian 306-14 feet, TD 3385.

Cowley County, Hittle, North field. Aladdin Petroleum's Summers 1, SW SW NW 15-31s-4e, pumped 25 barrels from Bartlesville sand, Pennsylvanian 3014-20 feet, TD 3610.

Harper County, Berg field. Beardmore Drilling Co.'s Berg 1, SW SW SE 29-32s-7w, pumped 134 barrels from Viola lime, Ordovician 4758-64 feet, TD 4983.

Pawnee County. Cities Service Oil Co.'s Risse 1, NE NE NE 14-20s-20w, pumped 506 barrels from Conglomerate 4170-82 feet, TD 4540.

Pratt County. Buffalo Oil & G-M-R's Lion 1-C, SE SE NW 21-27s-11w, pumped 355 barrels from Lansing lime, Pennsylvanian 3796-99 feet, TD 4515.

Chance, North field. A. G. Hill's Dodson 1, SE SE NW 21-26s-13w, pumped 168 barrels from Simpson lime, Ordovician 4421-37 feet, TD 4560.

Stafford County. Greenland Drilling Co.'s Birdsall 1, SE NE SE 21-23-14, pumped 168 barrels from Lansing lime, Pennsylvanian 3690-97 feet, TD 4075.

Rattlesnake, Southeast field. Natural Gas & Oil Corp.'s Harrison 1, SE NE SE 13-24-13, flowed 412 barrels from Lansing lime, Pennsylvanian 3764-3835 feet, TD 4210.

KANSAS—NEW OIL PAY

Ellis County, Sessins field. Okmar Oil Co.'s Albert 3, SW NE SW 10-11s-19w, pumped 89 barrels from Lansing lime, Pennsylvanian 3291-98 feet, TD 3563.

KANSAS—NEW GAS FIELDS

Ford County, Pleasant Valley, South field. City Products Corp.'s Vice 1, SW SW NE 14-28-21, flowed 7.8 million from Mississippi lime, Mississippian 5056-74 feet, TD 5230.

Seward County. Lansekan Oil Co.'s Good 1-B, NW NW NW 20-34-31, flowed 1.7 million from Mississippi dolomite, Mississippian 5947-65 feet, TD 6456.

KENTUCKY—NEW OIL FIELDS

Henderson County. Jet Oil's Haywood Alves 1, SW NW NE 19-Q-21, pumped 20 barrels from McClosky lime, Mississippian 2687-90 feet, TD 2690.

Smith Mills, South field. William E. Styles et al's Addielee Gabhart 1, in 11-P-21, pumped 150 barrels from McClosky lime, Mississippian 2571-78 and 2624-48 feet, TD 2678.

Mehlenberg County. H. C. Smith-L. McIntosh's Hugh Lewis 1, 3-H-28, pumped 25 barrels from 1235-55 feet, TD 1504.

SOUTH LOUISIANA—NEW OIL PAY

LaFourche Parish, Bully Camp field. Humble O&R Co.'s Delta Sec. Co., Inc. 2, in 34-18s-20e, flowed 292 barrels from 10,978-988 feet, ⅛-inch, 37.3-gravity, completed 3-22-54, TD 15,115.

SOUTH LOUISIANA—NEW DISTILLATE FIELD

Cameron Parish. R. W. O'Meara & M. L. Pray's James H. Fawvor, Sr. 1, in 40-15s-5w, flowed 21 barrels distillate and 1.7 million from 11,458-472 feet, 11/64-inch, 48.4-gravity, completed 3-11-54, TD 12,741.

SOUTH LOUISIANA—NEW DISTILLATE PAY

St. Charles Parish, Boutte field. Pan American Production Co.'s L. B. Simoneaux 5, in 20-14s-21e, flowed 250 barrels distillate and 4.7 million from 11,020-025

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feet, ¼-inch, 48.8-gravity, completed 3-7-54, TD 12,120.

SOUTH LOUISIANA—NEW GAS FIELD

Plaquemines Parish. Kerr McGee Oil Industries, Inc., State Lease 1237 F-1, Old Well Worked Over, flowed ungauged from 4127-33 and 3841-46 feet, completed 5-28-54, TD 6860.

SOUTH LOUISIANA—NEW GAS PAYS

Cameron County, Deep Lake field. Union Producing Co.'s State Lease 2340-Rockefeller 1, in 7-16s-3w, Old Well Drilled Deeper, ungauged from 13,140-156 feet, completed 3-9-54, TD 12,940.

Plaquemines Parish, Breton Sound area. Kerr McGee Oil's State Lease 2326 CC-1, in Block 20, ungauged from 4290-94 feet, completed 3-12-54, TD 7400.

MICHIGAN—NEW OIL FIELD

Allegan County. P. K. Degenther's Murback 1, SE NE SE 33-3n-14w, pumped 1 barrel from Traverse lime, Devonian 1395-97 feet, TD 1397.

NEW MEXICO—NEW OIL FIELD

Lea County. Western Natural Gas Co.'s Ramco-State 2, in 35-16s-35e, pumped 103 barrels oil and 26 barrels water from Wolfcamp lime, Permian 10,440-505 feet, 2-inch, 43.8 gravity, completed 3-8-54, TD 12,802.

NEW MEXICO—NEW GAS FIELDS

Lea County. Schermerhorn Oil Corp.'s Gulf-State 1, in 31-18s-37e, flowed 0.7 million from Queen sand, Permian 3745-3880 feet, open, completed 3-16-54, TD 3880.

San Juan County. Delhi Oil Corp.'s Florance 4—20, SE NW NE 24-30n-9w, flowed 8.3 million from Mesaverde sand, Upper Cretaceous, completed 3-20-54, TD 4945.

NORTH DAKOTA—NEW OIL FIELD

Mountrail County. Amerada Petroleum Corp.'s Bergitte Lokken 1, C NE SW, 2-157-n-94w, flowed 252 barrels oil and 88 barrels water from Madison sand, Mississippian 8420-30 feet, 48/64-inch, 38.8-gravity, completed 3-14-54, TD 8462.

NORTH DAKOTA—NEW OIL PAY

Billings County, Fryburg field. Amerada's Dan Cheadle Unit 1, C SE NW 9-139n, 100w, flowed 97 barrels from Heath sand, Mississippian 8271-78 feet, 2-inch, 31.2-gravity, completed 3-14-54, TD 9495.

OKLAHOMA—NEW OIL FIELDS

Creek County, Milfay, West field. Lotus Oil Co. & D&L Oil Co.'s Forrenda Woods 1-A, NW NE SE 18-15n-7e, pumped 24 barrels oil and 75 barrels water from 2nd Wilcox sand, Ordovician 4100-11 feet, 39-gravity, TD 4111.

Garvin County, Stratford, Southeast field. John H. Bracken's W. H. Burns 1, SE SE NW 36-4n-3e, flowed 45 barrels from 1707-13 feet, 20/64-inch, 29.5-gravity, TD 1762.

Kay County, Merrine, South field. H. Waggoner & Co.'s Lewis 1, NE NE NE 27-27n-3e, flowed 30 barrels from Lower Layton sand, Pennsylvanian 2377-2392 feet, 6/64-inch, TD 3463.

Lincoln County. Davidor & Davidor's Wakley 1, NE NE SE 21-15n-3e, flowed 198 barrels from Lower Skinner sand, Pennsylvanian 4294-4304 feet, 12/64-inch, TD 4314.

Major County. Livon Oil Corp.'s Claude E. Reese 1, NE NE NE 18-21n-11w, flowed 0.4 million from Cherokee sand, Pennsylvanian 6765-82 feet and pumped 60 barrels from Mississippi lime, Mississippian 7255-7330 feet, 18/64-inch, TD 7423.

Pottawatomie County, Tecumseh field. Blackwood & Nichols Co.'s School Land 1-B, SW SE SW 13-9n-3e, pumped 21 barrels from Simpson dolomite, Ordovician 5290-94 feet, 36-gravity, TD 5457.

Seminole County. Kimitz Drilling et al's Collins 1, SW NE NW 6-5n-6e, pumped 27 barrels from Senora sand, Pennsylvanian 2113-20 feet, 33-gravity, TD 2190.

Stephens County. Mack Oil Co.'s Oxford 1, NW NW SW 26-1s-4w, pumped 30 barrels oil and 30 barrels water from Pickens sand, Pennsylvanian 5110-44 feet, 17.5-gravity, TD 7520.

Prairiedale field. An-Son Petroleum Co.'s Baker 1, NE NW NW 35-1n-5w, pumped 146 barrels from Lower Hoxbar sand, Pennsylvanian 5229-74 feet, 31-gravity, TD 5702.

Tillman County, Victory, North field. Union Oil Co.'s Emenhiser 2, NW SE NE 23-3s-17w, pumped 80 barrels from Cisco sand, Pennsylvanian 3046-52 feet, 43.1-gravity, TD 3053.

OKLAMOMA—NEW OIL PAYS

Carter County, Tatums field. Stanolind O. & G. Co.'s Nicholson 2, NW NE SE 3-1s-3w, flowed 1413 barrels from Sycamore lime, Mississippian 7364-7520 feet, ¾-inch, 37-gravity, TD 10,560.

Hughes County, Grief Creek field. Leta M. Chapman's Eddie Bruner 7, SE SW NE 15-7n-9e, flowed 20 barrels from Hartshorne sand, Pennsylvanian 3130-38 feet, 15/64-inch, 48-gravity, TD 3180.

Jefferson County, Healdton field. Shell Oil Co.'s Samples 1, NE NE SE 25-3s-4w, flowed 40 barrels from Hoxbar sand, Pennsylvanian 1638-74 feet, 14/64-inch, 46-gravity, TD 2546.

Okfuskee County, Morse, Southeast field. Wilcox Oil Co.'s Cumseh 1, NW NW SE 10-12n-10e, pumped 75 barrels from 1st Wilcox sand, Ordovician 3562-88 feet, TD 3588.

Payne County, Orlando field. Creslenn Oil Co.'s Tompkins 1, NE SE NE 6-19n-1w, flowed 45 barrels oil and 40 barrels water from Cleveland sand, Pennsylvanian 4330-40 feet, 12/64-inch, 40.7-gravity, TD 5045.

OKLAHOMA—OIL FIELD EXTENSIONS

Kay County, Dilworth field. J. H. Wagner's J. R. Milligan 1, NE NE SW 3-28n-1e, east extension, Old Well Worked Over, pumped 25 barrels oil and 25 barrels water from Cleveland sand, Pennsylvanian 3279-89 feet, 42-gravity, TD 3989.

Uncas, Northeast field. A. C. Lawson's Cales 1, SW SE SE 20-27n-4e, east extension, flowed 360 barrels from Skinner sand, Pennsylvanian 3173-81 feet, 15/64-inch, TD 3250.

Logan County, Central School, South field. Zephyr Petroleum Co.'s House 1 SE SE NW 35-17n-1e, pumped 72 barrels oil and 8 barrels water from 5279-87 feet, 37-gravity, TD 5287.

Edmond, West field. Harper-Turner's Brouchoud 1, SE SW NE 21-15n-4w, flowed 79 barrels from 2nd Hogshooter lime, Pennsylvanian 5460-85 feet, 8/64-inch, 44-gravity, TD 5550.

Major County, Ringwood field. White Eagle Oil Co. & Julius Livingston's Coppock 1-B, NE SW SW 5-21n-11w, flowed 144 barrels from Manning sand, Mississippian 6896-6956 feet, 8/64-inch, and 182 barrels from Mississippi sand, Mississippian 7204-20 feet, 18/64-inch, TD 7287.

Payne County, Soonerville, North field. Foster Drilling Co.'s Williams 1, NW NW NE 11-17n-4e, pumped 15 barrels from Wilcox sand, Ordovician 4122-26 feet, TD 4150.

Stephens County, Prairiedale field. Samedan Oil Corp.'s Burkhart 1, NE SW NE 27-1n-5w, 1-mile north extension, pumped 103 barrels from Lower Hoxbar sand, Pennsylvanian 5195-5234 feet, 29-gravity, TD 5434.

OKLAHOMA—NEW DISTILLATE FIELD

Garvin County. C. P. Burton's Bob Roberts 1, SE SE SE 14-2n-1w, flowed 16 barrels distillate and 4.0 million from 2nd Deese sand, Pennsylvanian 4681-4702 feet, ½-inch, 70-gravity, TD 4635.

OKLAHOMA—NEW GAS FIELD

Beaver County. United Production Co.'s W. H. Kiser 1, NE NE 22-6n-2ecm, flowed 2.3 million from Basal Morrow sand, Pennsylvanian 6280-6310 feet, TD 6480.

OKLAHOMA—NEW GAS PAY

Payne County, Cottingham, Northeast field. Texas Pacific Coal & Oil Co.'s Josephine L. Story 2, NW SE NW 1-17-3e, flowed 3.2 million from Misener sand, Mississippian 4258-67 feet, 58-inch, TD 4402.

SOUTH DAKOTA—NEW OIL FIELD

Harding County, Custer field. Shell Oil Co.'s State 1-A, C SW SW 9-21n-4e, pumped 80 barrels oil and 202 barrels water from Red River lime, Ordovician 8587-8600 and 8660-8691 feet, completed 3-15-54, TD 9335.

TEXAS DISTRICT 1—NEW OIL FIELD

Atascosa County. W. A. Richardson, Jr. Tr.'s E. E. Wilson 2, BS&W Survey, flowed 182 barrels from 5425-74 feet, 11/64-inch, 38-gravity, completed 3-20-54, TD 5474.

TEXAS DISTRICT 1—OIL FIELD EXTENSION

Atascosa County, Armstrong & Horn field. Lewis Oil Co.'s Marrs McLean Est. 1, Solomon Simmonds Survey 1439, ½-mile northeast extension, flowed 93 barrels from 5045-78 feet, ⅛-inch, 38.5-gravity, completed 3-7-54, TD 5078.

TEXAS DISTRICT 1—NEW GAS FIELD

McMullen County. J. W. Gorman's Hagist Ranch 2, G. B. Kinney Survey 8, flowed 1.8 million from 2178-81 feet, completed 3-12-54, TD 2857.

TEXAS DISTRICT 3—NEW OIL FIELDS

Brazoria County, Lurey field. Reynolds Mining Corp.'s A. H. Burrows et al 1, John Peske Survey, flowed 83 barrels from 9538-51 feet, 3/16-inch, 33.7-gravity, completed 3-1-54, TD 10,200.

Harris County, Aldine, Northeast field. Union Production Co.'s Bender Estate 1—1, N. W. Travis Survey, pumped 30 barrels oil and 24 barrels water from Fairbanks sand, Eocene 7073-74 feet, 38.1-gravity, completed 3-3-54, TD 8015.

Jefferson County, Marrs McLean field. Stanolind O&G Co.'s Marrs McLean "B" 1-B, flowed 79 barrels oil and 51 barrels water from 11,369-375 feet, 13/64-inch, 29.4-gravity, completed 2-10-54, TD 12,888.

TEXAS DISTRICT 3—NEW OIL PAYS

Galveston County, Hitchcock field. Stewart Petroleum Co.'s Maco Stewart 23, James Spillman Survey, flowed 77 barrels oil and 19 barrels water from 6083-92 feet, 3/16-inch, 33-gravity, completed 3-22-54, TD 6801.

Harris County, Clinton, South field. Reynolds Mining Corp.'s Mamie Furr 1, Martinez Survey, flowed 128 barrels from Vicksburg "C" sand, Oligocene 6470-75 feet, 3/16-inch, 36.7-gravity, completed 3-19-54, TD 9020.

Mykawa, Southwest Flank field. Jack W. Frazier's The Minnetex Co. 2-A, Wm. Lovett Survey, flowed 213 barrels from 4830-37 feet, 12/64-inch, 26.8-gravity, completed 3-29-54, TD 6203.

Jefferson County, Big Hill field. Delta Drilling Co.'s Security Bank 2, T&NO RR Co. Survey 175, flowed 308 barrels from Frio "C" sand, Oligocene 10,468-482 feet, 12/64-inch, 30-gravity, completed 2-3-54, TD 10,557.

Big Hill, West field. Kilroy Co. of Texas Inc.'s Selma Erikson 1, Section 176, W. H. Baldwin Survey, flowed 199 barrels from Marginulina sand, Oligocene 9252-54 feet, completed 3-1-54, TD 10,529.

Liberty County, Hankamer field. Dan J. Harrison, Jr.'s Dan J. Harrison, Jr. "A" Fee 3, H&TC RR Co. Survey 3, flowed 111 barrels from 4412-20 feet, ⅛-inch, 25-gravity, completed 3-2-54, TD 6150.

Matagorda County, Markham field. Lee Brothers Oil Co.'s Kountze-Stewart 2, Henry Parker League, flowed 166 barrels from Frio sand, Oligocene 4798-4822 feet, ⅜-inch, 38-gravity, completed 3-17-54, TD 4872.

TEXAS DISTRICT 3—NEW DISTILLATE FIELD

Matagorda County, Sanborn field. Stanolind O&G Co.'s Raleigh Sanborn 1, Soloman Williams League flowed 300 barrels distillate and 12 million from Frio sand, Oligocene 13,032-052 feet, 41.5-gravity, completed 1-29-54, TD 16,120.

TEXAS DISTRICT 3—NEW DISTILLATE PAY

Liberty County, Liberty Townsite field. Eddy Refining Co.'s Cornell College 1, E. Liberty Town League Survey, flowed 500 distillate and 20.0 million from Cook Mountain sand, Eocene 11,542-563 feet, 54.8-gravity, completed 3-13-54, TD 11,632.

TEXAS DISTRICT 4—NEW OIL FIELDS

Aransas County, West Rockport field. Heep Oil Corp.'s et al's Zeph Roquette et al 1, John G. Smith Survey, flowed 188 barrels from 8284-90 feet, 9/64-inch, 40-gravity, completed 3-16-54, TD 8286.

Duval County, "Casa Blanca, South" field. The Texas Co.'s DCRC NCT-13 A-1, Survey 64, pumped 93 barrels from Jackson-Cole sand, Eocene 1324-38 feet, 20.6-gravity, completed 3-23-54, TD 2660.

San Patricio County, "Mary Bluntzer" field. S. H. Howell's Mary Bluntzer 1, Block 84, San Patricio De Hibernia Town Tracts, flowed 148 barrels from 6116-17 feet, 8/64-inch, 41-gravity, completed 3-23-54, TD 6512.

Webb County, "Conchudo" field. W. L. Cotton Inc. & L. G. Shelly's Rosa V. de Benavides 2, Survey 1087, pumped 18 barrels from 2327-33 feet, 22.8-gravity, completed 3-20-54, TD 2395.

TEXAS DISTRICT 4—NEW OIL PAYS

Jim Wells County, Captain Lucey field. Lyman-Damascus Operations' Fred Erck 5, R. King Farm Lots, Lot 15, flowed 127 barrels from 4818-4837 feet, 13/64-inch, 33.1-gravity, completetd 3-17-54, TD 4999.

Nueces County, Calallen field. Phillips Petroleum Co.'s M. L. Wood Est. 1, Eade Riverside Subdivision, Section 5, flowed 210 barrels from Frio sand, Oligocene 8316-22 feet, 9/64-inch, 43.1-gravity, completetd 3-1-54, TD 9643.

TEXAS DISTRICT 4—NEW DISTILLATE PAYS

Hidalgo County, San Manuel field. Magnolia Petroleum Co.'s Garza Unit 2—1, San Salvador Del Tule Grant, flowed 20 barrels distillate and 2.6 million from 7598-7616 feet, 51.9-gravity, completed 3-11-54, TD 10,500.

Sullivan City field. Clark Fuel Production Co. & K. W. Owen's Nieves Ramirez 1, Porcion 41, Block 9, ungauged from 5244-66 and 6016-38 feet, completed 3-15-54, TD 6319.

Jim Wells County, Tijerina-Canales-Blucher field. La Gloria Corp.'s C. F. H. Blucher 35, Survey 363-A, ungauged from Harvey sand, Oligocene 7413-22 feet, completed 2-22-54, TD 8002.

TEXAS DISTRICT 4—DISTILLATE FIELD EXTENSION

Hidalgo County, San Salvador field. Magnolia Petroleum Co.'s Richard King Unit (G. M. de Dominguez) 1, Las Mestenas Grant, Share E. Block 6, ¾-mile southeast extension, flowed 155 barrels distillate and 17.2 million from 6580-6629 feet, 61.6-gravity, and 143 barrels distillate and 10.6 million from 6272-6309 feet, 63.8-gravity, completed 1-28-54, TD 6691.

TEXAS DISTRICT 7C—NEW OIL FIELDS

Runnels County. Bert Fields' J. W. Smith et al 1, Section 15, Block 440, T. M. Fowler Survey, flowed 267 barrels from Fry sand, Pennsylvanian 4330-40 feet, 16/64-inch, 50-gravity, completed 3-26-54, TD 4885.

Tom Green County. P. Q. Echols' Isaac Funk Estate B-1, Section 30, Block 5, H&TC Survey, pumped 22 barrels from 860-70 feet, 35.3-gravity, completed 2-8-54, TD 870.

Unnamed field. Stanolind O&G Co.'s Hoblett & Jacobs Ranch Co. 1, C&M RR Survey No. 1131, flowed 242 barrels from Strawn sand, Pennsylvanian 5502-12 feet, 12/64-inch, 41.1-gravity, completed 3-10-54, TD 5539.

Upton County. Humble O&R Co.'s Ella M. Corbett 1-B, Section 19, Block B-2, GC&SF Survey, pumped 45 barrels oil and 29 barrels water from Wolfcamp lime, Permian 6363-68 feet, 2-inch, 38.5-gravity, completed 3-9-54, TD 6855.

TEXAS DISTRICT 7C—GAS FIELD EXTENSION

Crockett County, Todd, North field. Cummins, Berger & Smith's Shannon Estate 1-C, Section 12, Block 9, D&SE Survey, ¾-mile east extension, flowed 0.8 million from San Andres lime, Permian 1690-1730 feet, 2-inch, completed 2-26-54, TD 1840.

TEXAS DISTRICT 8—NEW OIL FIELDS

Andrews County. Cities Service Oil Co. et al's University 1-S, Section 27, Block 10, University Lands Survey, flowed 77 barrels from Permian lime 4268-4358 feet, 18/64-inch, 33-gravity, completed 3-12-54, TD 4460.

Unnamed field. Hunt Oil Co.'s J. M. White et al 1, Section 13, Block A-34, PSL Survey, flowed 496 barrels from Ellenburger lime, Ordovician 13,272-322 feet, 12/64-inch, 44.1-gravity, completed 3-11-54, TD 13,560.

Unnamed field. Ralph Lowe et al's Deep Rock et al 1, Section 5, Block A-46, PSL Survey, flowed 407 barrels from Ellenburger lime, Ordovician 12,252-278 feet, 14/64-inch, 43.8-gravity, completed 2-28,54, TD 12,479.

Borden County. Falcon Seaboard Drilling Co.,-Green & McSpadden's Clayton & Johnson 1, Section 6, Block 32, T-4-N, T&P Survey, flowed 203 barrels from Reef lime, Pennsylvanian 8236-40 feet, 10/64-inch, 45.8-gravity, completed 3-16-54, TD 8266.

Cochran County. Stanolind O&G Co. et al's D. C. Reed 1-D, Section 58, Harrison Brown Survey, pumped 98 barrels oil and 28 barrels water from Devonian lime, Devonian 11,861-870 feet, 38-gravity, completed 2-17-54, TD 12,742.

Gaines County. Amerada Petroleum Corp. et al's Stanton-Brunson 1, League 308, Terrell CSL Survey, flowed 1868 barrels from Devonian lime, Devonian 12,764-728 feet, ¾-inch, 34-gravity, completed 3-8-54, TD 12,796.

Garza County. Joseph I. O'Neill, Jr.'s Mrs. Gladys Floyd 1, Section 1298, D&WRR & TTRR Survey, pumped 94 barrels from San Andres lime, Permian 3400-25 and 3435-45 feet, 2-inch, 36-gravity, completed 3-12-54, TD 3454.

Howard County. Lone Star Producing Co.'s J. O. Haney, Section 22, Block 32, T-2-N, T&P Survey, flowed 326 barrels from Siluro-Devonian sand, 9880-9918 feet, 24/64-inch, 44.1-gravity, completed 3-15-54, TD 9936.

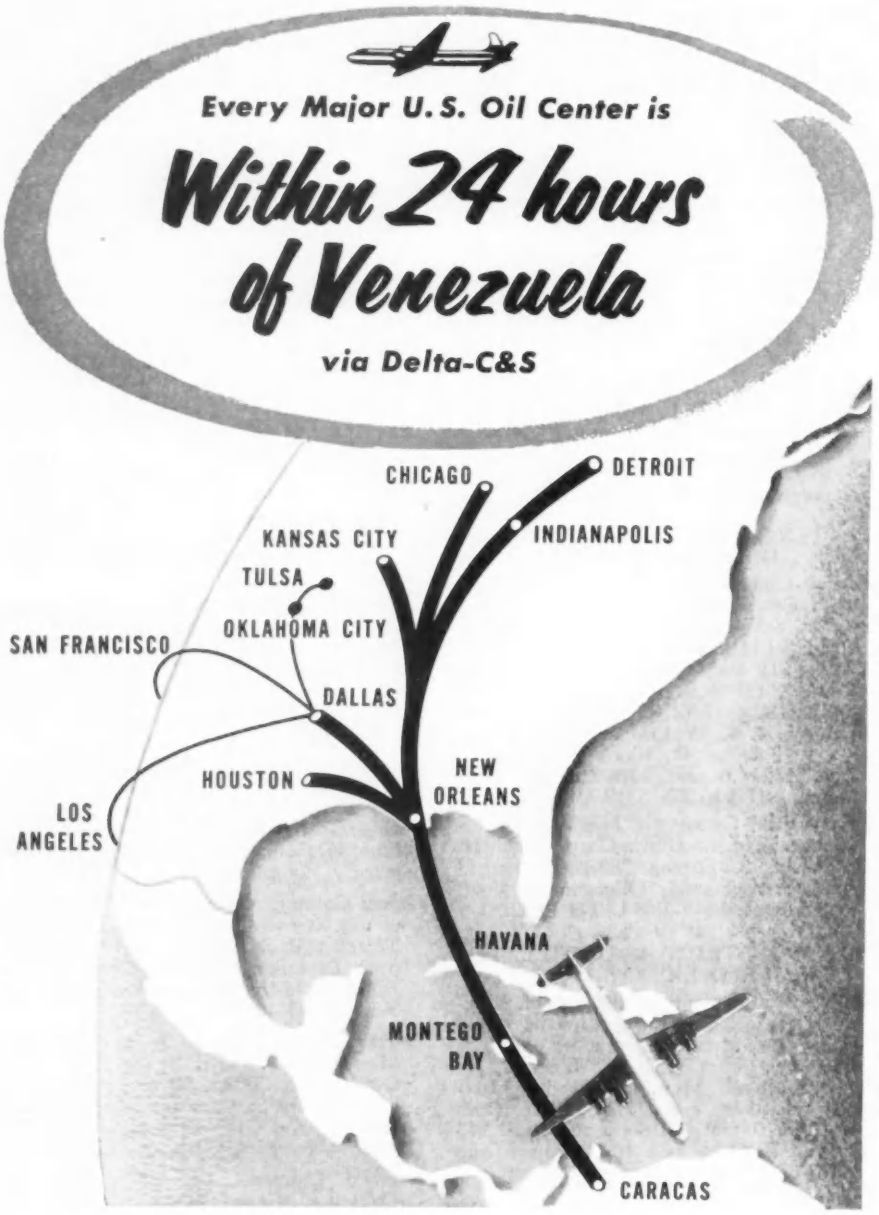
Kent County. King Oil Inc.'s C. E. Cargile 1, Section 25, Block 5, H & GN Survey, flowed 103 barrels from Strawn sand, Pennsylvanian 7237-45 feet, 16/64-inch, 39.5-gravity, completed 3-4-54, TD 7882.

Loving County. Hanlon-Boyle, Inc.'s Heartwell-Britton 1, Section 57, Block 1, W&NW Survey, flowed 46 barrels oil and 23 barrels water from Delaware sand, Permian 4463-65 feet, 17/64-inch, 39-gravity, completed 1-4-54, TD 4465.

Reeves County. Neville G. Penrose, Inc.'s Allar Co. 1-A, Section 18, Block 56, T-3, T&P Survey, flowed 46 barrels from Delaware sand, Permian 3471-76 feet, 16/64-inch, 38-gravity, completed 2-23-54, TD 3476.

TEXAS DISTRICT 8—NEW OIL PAYS

Scurry County, Fluvanna field. Fred Goodstein's W. F. Mathis 1, Section 537, Block 97, H&TC Survey, flowed 190 barrels from Strawn sand, Pennsylvanian 7849-58 feet, 31/64-inch, 41.5-gravity, completed 2-27-54, TD 8380.



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TEXAS DISTRICT 8—NEW OIL PAY
TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Andrews County, Midland farms, Northeast field. Shell Oil Co.'s University 1-C, Section 21, Block 1, University Lands Survey, ½-mile southwest extension, flowed 520 barrels oil and 16 barrels water from Ellenburger lime, Ordovician 12,410-549 feet, 10/64-inch, 53-gravity, completed 2-19-54, TD 12,549.

Parker-Wolfcamp field. Sinclair O&G Co.'s H. M. Ford 1-A, Section 21, Block A-43, PSL Survey, ¾-mile southwest extension, flowed 696 barrels from Wolfcamp lime, Permian 8629-59 feet, ¾-inch, 36.5-gravity, completed 3-19-54, TD 8696.

Yoakum County, Bronco-Devonian field. Felmont Oil Corp.'s Kendrick 1, Section 455, Block D, J. H. Gibson Survey, 1-mile south extension, flowed 1148 barrels from Devonian lime, Devonian 11,735-785 feet, ¾-inch, 46-gravity, completed 3-10-54, TD 11,785.

TEXAS DISTRICT 8—NEW GAS FIELD

Pecos County. Gulf Oil Corp.'s State "DU" 1, Section 7, Block 28, University Lands Survey, Old Well Worked Over, flowed 7.3 million from O'Brien sand, Permian 2552-58 and 2582-92 feet, 2-inch, 58-gravity, completed 2-12-54, TD 3000.

TEXAS DISTRICT 10—NEW OIL FIELD

Potter County. Sinclair O&G Co.'s C. Bivins 4-A, Section 17, Block O-18, D&P Survey, pumped 13 barrels from Granite Wash sand, Pennsylvanian 3202-22 and 3292-3323 feet, 32.1-gravity, completed 2-24-54, TD 3350.

WYOMING—NEW OIL FIELDS

Converse County, Glenrock area. Canada Southern & Illinois-Wyoming Oil Co.'s State 22-1, SE SE 22- 33n-76w, pumped 12 barrels from Muddy sand, Upper Cretaceous 5352-65 and 5365-78 feet, completed 3-7-54, TD 5540.

Fremont County, Sheldom Dome area. Skelly Oil Co.'s Tribal 1, SW SW SW 36-6n-3w, pumped 231 barrels from Triassic sand 3265-95 and 3308-18 feet, completed 3-24-54, TD 3384.

Natrona County, Notches area. Superior Oil Co.'s 14, Unit 16, SW NW SW 14-37n-85w, pumped 24 barrels from Phosphoria lime, Permian 2931-39 and 2970-75 feet, completed 1-20-54, TD 2999.

Niobrara County. Hayes & Harris Drilling & Oil Co.'s Nio-Wilson 1, NE NW NW 14-40n-66w, flowed 200 barrels from Newcastle lime, Upper Cretaceous 7606-54 feet, completed 3-10-54, TD 7720.

Washakie County, Nieber Dome area. The California Co.'s Nieber Unit 6, SW NE SE 21-45n-92w, flowed 489 barrels from Phosphoria lime, Permian 10,022-045 feet, 26/64-inch, completed 3-18-54, TD 10,045.

Weston County. Trans-Texas Drilling Co.'s State 1, NE NW 20-41n-66w, flowed 50 barrels from Newcastle lime, Upper Cretaceous 7497-7502 feet, completed 3-27-54, TD 7570.

Black Thunder area. Dunbar Drilling Co.'s Dixon 1-B, NE SE SE 10-41n-66w, flowed 672 barrels from Newcastle lime, Upper Cretaceous 7210-20 feet, ½-inch, completed 3-9-54, TD 7271.

WORLD OIL's Special Report on Slim Hole Drilling

Industry takes a new look at slim hole drilling

For many years the industry has studied and talked about slim hole drilling. Today, slim hole drilling again is very much in the limelight.

Modern slim hole drilling involves the drilling of much smaller diameter holes than have become common as a result of efforts 10, 20, and even 30 years ago.

Twenty to 25 years ago operators recognized the possibility of cutting the cost of drilling and producing deep wells through the use of smaller diameter holes. It was realized that this would:

- Permit the drilling of other wells with the money saved by lower cost.
- Economically justify exploration in areas where there was less than average chance of production.
- Permit development of geological data at reduced cost.
- Allow testing of producing properties at less cost.

Limitations overcome. Several limitations prevented the prompt realization of the above advantages. However, as the years passed most of these limitations have been removed one by one with the development of equipment and technology.

More positive well control now enables light rigs to be used, even in high-pressure areas.

High-pressure and high-volume pumps permit application of better hydraulics. The basic principles of drilling must be properly applied before penetration rates will show marked improvement.

Proration and advanced reservoir engineering have removed the need for former production advantages of larger hole size.

Improved alloy steels and better thread connections now permit long strings of small diameter pipe to be run safely, where early grades of steel favored large diameters. Industry has now scaled down the concept, "We need large production casings," to an acceptable 5-5½ inches.

Better trained field personnel with a better understanding of the vastly improved equipment recognizes the ability to work with close tolerances in a small hole.

New tools now make it possible to fish, log, squeeze, cement, perforate, acidize, and install rods, hydraulic pumping or gas lift equipment inside of two-inch tubing. Small diameter wells can be completed and reworked without the hazards or costs of yesterday.

Problems remain. This is not to say that even the warmest adherents of slim hole drilling feel that this technique now offers the entire answer. But there is a growing belief that in the event large hole drilling does not provide the optimum answer, the slim hole method holds almost the only alternate.

Of the objections voiced to slim hole drilling as it is now done, most may be answered by engineering advances. Specifically, the answers may be forthcoming in still further developments of high-pressure and low-volume pumps, improved bits in smaller sizes, fishing tools more adaptable to small holes, and a small bridging plug.

Advancements also will come with broader acceptance of certain new and flexible techniques which could be regarded as unorthodox. Tomorrow's deep wells, for instance, may be completed with 2⅞-inch tubing as casing.

The pages which follow constitute a detailed report on modern slim hole drilling. With the aid of more than a score of industry authorities, we offer for the first time in one package the answers to most of the problems arising from the use of this new and promising technique.

PHILIP L. MCLAUGHLIN
Drilling Editor

What Are the Slim Hole Problems?

Tests show that there are many with today's equipment. But they can all be 'engineered.'

Questions now on the minds of drilling and production people are answered below for WORLD OIL by leading authorities versed on the various technical problems incident to slim hole drilling.

What about the technical aspects of the slim hole method? Does a rig capable of hoisting 14,000 feet of light drill pipe have the pump capacity to drill that deep? Will an ice pick hole have less tendency to disturb the fracture patterns of a formation? Are present day bits suitable? Does the industry have enough slim hole history to evaluate the method? Do we have adequate slim hole equipment? Will the hole deviate less with slim hole?

Doubts are raised. Some people argue that the problems outweigh benefits. Others say that we can economically drill with today's equipment but can show better results tomorrow.

WORLD OIL interviewed and sent questionnaires to the people who manufacture slim hole equipment, drilling experts who have drilled slim holes, and to engineers and management of oil companies.

Here are their answers.

By PHILIP L. McLAUGHLIN, WORLD OIL Staff

Q *What is your definition of a slim hole? What size bits fit this category?*

A The definition of a slim hole seems to be a matter of opinion. Holes as large as 7⅞ inches are called "slim hole" in Louisiana, while in California "ultra slim holes" measure 2¾ inches. Slim hole is best defined as a hole diameter of 6¾ inches or less. The more popular sizes now in use are: 6¾-inch, 6¼-inch, 6⅛-inch, 6-inch, 5⅞-inch, 4¾-inch, and possibly 3⅞-inch. One bit company expressed the opinion that any hole smaller than 4¾ inches in diameter is economically impractical when viewed in the light of present-day drilling methods.

Q *What's the hydraulic picture?*

A The hydraulic story is told in the accompanying curves, plotted from Hughes Tool Company hydraulic tables for the purpose of showing the pressure requirements for various slim hole sizes up to 14,000 feet, using different size drill pipe. (See Figure 1.)

For a 6⅛-inch hole using the hypothetical conditions indicated, it will be found that pump pressures of 3500 pounds per square inch will be needed for an 8000-foot well using 2⅞-inch slim hole drill pipe, requiring 443 hydraulic horsepower. By using 3½-inch slim hole drill pipe, the pressure at that depth will be reduced to 1200 psi.

Figures 2 and 3 show the same plot for 5⅜-inch and 4¾-inch hole sizes. Figure 3 indicates the significant hydraulic advantage of the smaller 4¾-inch hole. As clearances are reduced, the pressures are less.

The need for high-pressure, low-volume pumps is apparent from this study.

(Editor's Note: See the MacDonald article this issue for actual field results.)

Q *What will be the bit manufacturers' problems in designing bits?*

A The problems in designing rock bits have always increased as the size decreases. Slim hole sizes of bits have been in use for a great number of years and have performed very satisfactorily. However, these sizes of bits have been used primarily in medium-hard and hard formations inasmuch as they were generally used as a drilling-in bit. It appears that the main problem confronting bit manufacturers is the further development of a bit for soft formations.

The vast experience that bit manufacturers have had with larger sizes of bits for soft-formation drilling has enabled them to produce the bits of high quality currently being used. While some of this experience may be used in designing small bits for soft formations, considerable experimental work will have to be done to balance cutting structure, cutter shell and bearings to withstand longer hours in the hole at higher rotary speeds than used on these bit sizes in the past. Size limitation makes this problem very difficult.

Bit manufacturers have a tremendous problem in designing the smaller bits because of a lack of space. The entire structure must be reduced so drastically that sections reach the minimum rather quickly. We must appreciate the fact that weight must be applied to the bit to produce penetration. In the smaller sizes the weight required is proportionally larger than in the large bits. This, of course, results in higher stresses and greater possibility of failure. It is also very difficult to provide adequate cutting elements or teeth to the smaller bits.

Q *Can you give some information relative to jet nozzles versus conventional nozzles as applied to slim hole bits?*

A Due to limited field experience with slim hole drilling to date it is not possible to determine optimum

circulation rates and jet velocities in slim hole bit sizes. However, one bit manufacturer says that the use of jet nozzles in these bits will improve performance in the same manner as they have in larger sizes. There is still the problem of keeping the bottom of the hole clean in this size of bit as in the larger sizes of bits. The softer the formation and the greater the penetration rate, the more the improvement in performance will be noticed in these slim hole bits provided adequate volume and jet velocities are used. With a given penetration rate, the volume of fluid or jet velocities required should be less in these slim hole

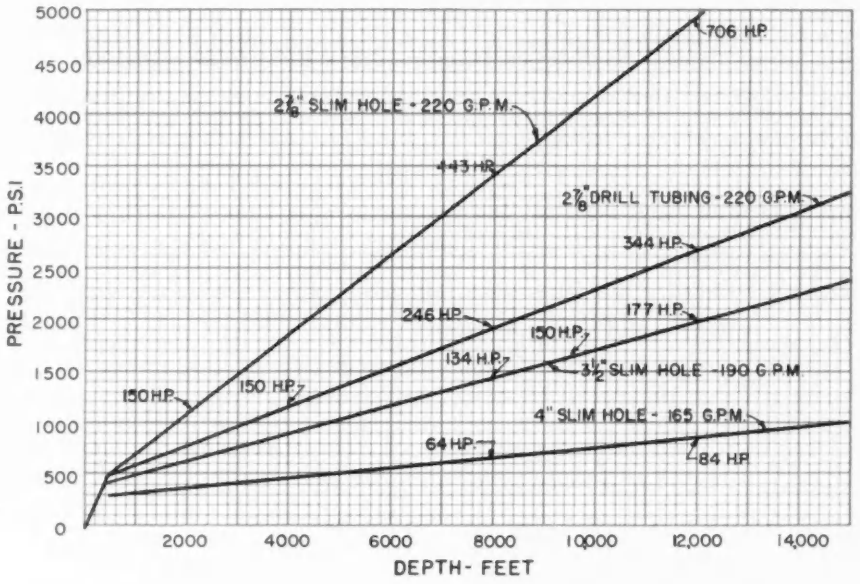


Fig. 1 (above)—Hydraulic requirements for a 6⅛-inch hole showing a plot of total pressure (less bit) vs. depth, for a return velocity of three feet per second using 500 feet of 5-inch OD by 1¾-inch ID drill collars. Various size drill pipes are indicated.

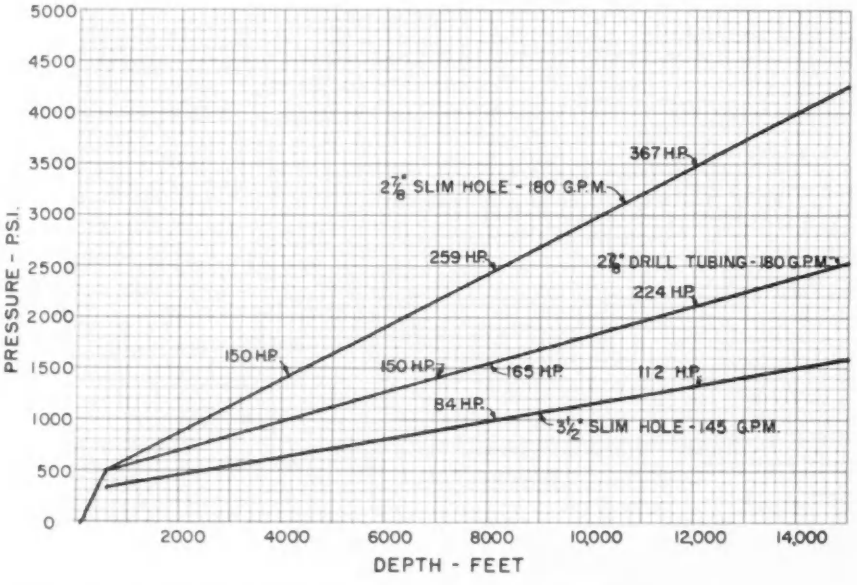
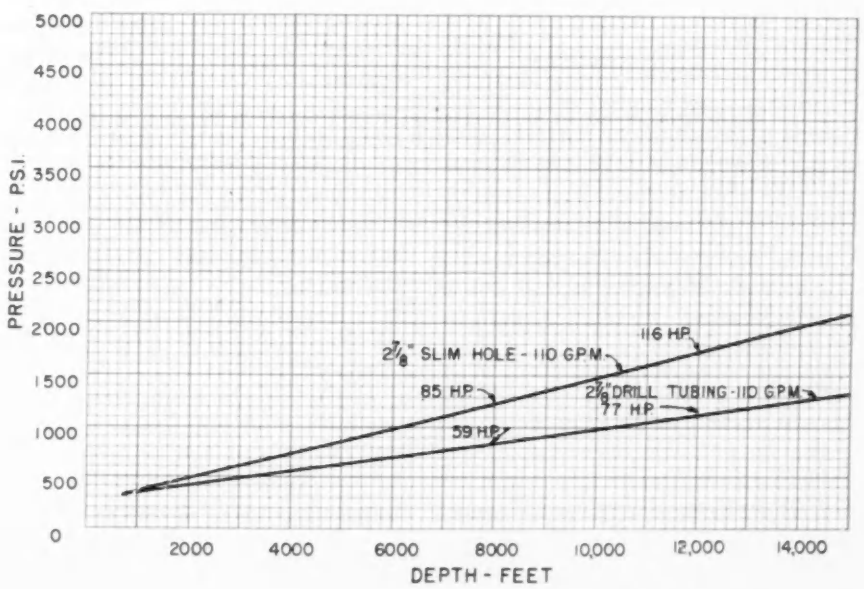


Fig. 2—Hydraulic requirements for a 5⅝-inch hole showing plot of total pressure (less bit) vs. depth, for return velocity of three feet per second, using 550 feet of 4¾-inch OD by 1¾-inch ID drill collars. Various size drill pipes are indicated.

sizes due to a smaller volume of material being removed.

Past experience has indicated that jet bits are superior to conventional nozzle bits when operated within the recommended ranges of velocities both discharge and return annulus. The economics of maintaining a high discharge velocity in small holes is going to require considerable study. Jet drilling in its simplest form means only that a great percentage of the energy of the drilling fluid is being delivered to the bottom of the hole where the

Fig. 3 (below)—Hydraulic requirements for a 4¾-inch hole showing plot of total pressure (less bit) vs. depth, for return velocity of three feet per second, using 700 feet of 4-inch OD by 1¾-inch ID drill collars. Various size drill pipes are indicated.



Formula Method of Calculating Rates

The next step in making a decision whether to use the slim hole technique is one of economic comparison. Here's a sample problem which shows the effect of footage rates.

FORMULA

$$\text{Cost/foot} = \frac{\text{Bit Cost} + \text{Rig Cost/hr (Drilling Time} + \text{Trip Time)}}{\text{Bit Footage}}$$

Case 1—Rates in soft formations

Example using 1000 feet per bit, $100 bits, 20 hours drilling time, 4 hours trip time and $40 per hour rig.

$$\text{Cost/foot} = \frac{\$100 + \$40/\text{hr}\ (20+4)}{1000\ \text{Ft.}} = \$1.06$$

In this case the bit cost is small compared to the effect of other variables.

If 250 feet is made with the bit (all others constant):

$$\text{Cost/foot} = \frac{100 + 40\ (24)}{250} = \$4.25$$

Bit cost has little effect up to 250 feet. In soft digging the drilling cost per foot is almost proportional to rig cost per foot.

Case 2—Rates in hard rock drilling:

Example using 50 feet per bit, $100 bits, 7 hours drilling and 4 hours trip time and $40 per hour rig.

$$\text{Cost per foot} = \frac{\$100 + \$40\ (7+4)}{50\ \text{feet}} = \$10.80$$

As formations get harder the cost per bit becomes increasingly important. This means that if slim hole rig operating cost hour is half that of conventional rigs, then considerable bit footage and penetration rate may be sacrificed before the slim hole drilling costs exceed those of a conventional rig.

The equation becomes:

$$\frac{\$/\text{hr}}{\text{Penetration rate}} + \frac{\left(\text{Trip time} \times \frac{\$}{\text{hr}}\right) + \text{Bit Costs}}{\text{Bit Footage}}$$

Case 1A—Big rig is assumed to drill with a bit capable of 1200 feet at 80 feet per hour. Rig Costs $40 per hour and the bit costs $150.

$$\text{Cost/ft} = \frac{\$40/\text{hr}}{80\ \text{ft/hr}} + \frac{(6\text{x}40) + \$150}{1200\ \text{feet}} = \$0.83$$

Case 2A—A little rig would use a cheaper bit, get less footage and would receive a cheaper rate. Assume rig cost $20 per hour using $100 bits which make 700 feet at 40 feet per hour.

$$\text{Cost/ft} = \frac{\$20/\text{hr}}{40\ \text{ft/hr}} + \frac{(6\text{x}20) + \$100}{700\ \text{feet}} = \$0.81$$

If rig time is cut in half based on six-hour trip time, the penetration rate could be cut in half, the footage could be reduced by approximately a third before drilling cost per foot would be reduced below the cost of the larger rig.

work is being done. The economical application of this principle should greatly improve the relative performance of the bits.

Q *What size and type tool joints should be needed for slim hole?*

A The size and type of tool joint needed will depend on size of hole and size of drill stem being used. The following tabulations show what may be needed:

Hole Size	Pipe Size	Type Tool Joint
4¾"	2⅞"	2⅞" IF
5⅜"	2⅞"	2⅞" IF
	3½"	3½" IF; 3½" XH
		3½" SH
6¼"	3½"	3½" IF; 3½" XH
	4"	4" FH; 4" SH

Flash-weld type of tool joint is available, and appears to offer some advantages over the screw type. With certain types of tool joints, such as the slim hole design, the flash-weld construction definitely will help the hydraulic problem by enabling the use of larger inside diameters and smaller outside diameters.

For hole sized down to 5⅞ inches there is a good selection of tool joints as practically all types of 3½-inch joints are applicable. In the hole sizes below 5⅞ inches the selection in standard joints is not as great. However, 2⅜ inches and 2⅞ inches in API regular and counterbore weld are available. Tubing tool joints are also available in the smaller sizes. All types, generally speaking, are available in both the flash-weld and screw-type connections.

Q *What about slim hole bit demand? What types will be used?*

A One bit manufacturer anticipates a heavy demand for smaller equipment in many sizes and variations until such time as an integrated program is developed and a trend is established. Problems may be:

Rock Bits—A very active program is anticipated in hole sizes from 6¾ to 2¾ inches, with the most emphasis being placed on the range from 5⅞ to 6¾ inches. The larger the size hole drilled the less mechanical problems to expect in design and therefore performance. Where the hole being drilled is to extend below 500 feet some thought and development will have to be devoted to the hydraulics.

It is entirely possible that a two-cutter bit design in these small sizes will prove to be the best approach. This design permits the use of the largest diameter cutters possible within the confines of the hole to be drilled. Large cutters mean greater structural strength in all component parts. Also the bottom hole cleaning of loosened cuttings can be more efficiently accomplished.

Drag Bits—Where the formations are soft enough to be drilled by this type of bit economical performance can be obtained. Structural strength and cleaning can be easily provided. Some new shapes may be developed for better performance and longer life.

Diamond Bits—Diamond bits are available in wide ranges of hole size. In smaller sizes diamonds may come into their own.

Coring Equipment—The recovery of small diameter cores is often quite difficult, however adequate conventional equipment is available in sizes from 3⅞ inches up. This equipment can employ drag-type heads, rotary

cutter heads, or diamond heads depending upon the type of formation drilled and the preference of the user.

Because of space limitations coring in the smaller diameter from 5⅞ inches down will probably have to be done with conventional equipment. In the sizes above 5⅞ inches adequate wire line equipment is available. Example of popular core barrel sizes are shown below.

Tool Joints—At the present time there are several schools of thought on what type of drill pipe connector should be used. For all-around efficiency a drill stem having a flush ID and as near flush on the OD as possible appears to have considerable merit. Where water is used to purge the hole of cuttings considerable thought must be given to penetration with low pumping costs.

Q *What is the current thinking on drill pipe vs. casing?*

A Casing possibly has several advantages over drill pipe in the smaller sizes. Less pressure loss will exist in the drilling string, the string will be lighter and easier to handle, and its salvage use for line pipe should be considered. The most striking disadvantage is the couplings required. These are fragile and the fine threads are not as easy to care for as the coarse tool joint threads. (Editor's Note: Some manufacturers are studying this problem.)

Q *What drill collar sizes will be recommended? How many should be used?*

A Due to the small hole diameters it is believed that the drill collar string should consist of collars having an OD of not less than three fourths of an inch smaller than the ID of the hole being drilled. The bore through the collars should be as large as practical to reduce pressure loss through this portion of the drill string. The number of collars necessary in the string should be from one to two more than required to produce the maximum desired drilling weight on the bit. The drill pipe should always be in tension and approximately 10 percent of the drill collar string should also be in tension.

If slim hole is accepted, the industry must learn to accept calculated risks. Clearances are only relative. Eleven-inch drill collars have been run inside 12¼-inch holes and nothing thought about it. But put a 4-inch drill collar inside a 4¾-inch hole, and the question of room to work arises. Some feel that oversized collars are desirable because they help in walling up the hole and stabilizing it, too.

Q *What penetration rates might one expect on various size bits?*

A Generally speaking, the rates of penetration in the smaller holes will be comparable to the larger diameter holes when drilled by the same method or procedure in the same formations. The life expectancy of the bits, that is, the total footage obtained, will in all probability be less.

One contractor indicated that with the proper pumps and by putting weight on the bit, performance will be comparable.

Q *What problems do you foresee?*

A The primary problem of slim hole drilling as it exists today is the lack of strength of all the component parts which are used below the ground level. As the hole diameter becomes smaller this problem becomes greater and more difficult to control or correct. Where failure occurs the problem of salvaging the hole and equipment is much more difficult.

Q *How will hole deviation be controlled?*

A Hole deviation can be controlled by the use of larger OD drill collars, drilling weight control, and maintaining all the drill pipe string in tension as well as a portion of the drill collars. Oversized collars help in a slim hole just as in a big hole.

Henry Woods of Hughes Tool Com-

Why Are Operating Costs on Slim Hole Rig Less Expensive Than on a Conventional Rig?

HOW TO CALCULATE DAILY OPERATING COSTS**	CONVENTIONAL RIG	SLIM HOLE RIG
CHARGES:		
1. Rig Depreciation	Conventional 600 H.P. rig with 500,000 lb. capacity derrick. Total Rig Investment = $300,000. Based on 1500 day operating depreciation period this daily depreciation rate is: $200/day	Total Slim Hole Rig Investment = $120,000. Based on 1500 day operating depreciation period this daily depreciation rate is: $ 80/day
2. Drill Pipe Depreciation	10,000 ft. of 4½" OD at $4/ft = $40,000 ÷ 1000 day depreciation $ 40/day	10,000 ft. of 2⅞" at $2/ft = $20,000 ÷ 1000 day depreciation $ 20/day
3. Labor and Insurance	(Estimated) 3–5 man crews $315/day	(Estimated) 3–4 man crews $260/day
4. Fuel Costs	(Estimated) $ 75/day	(Estimated) $ 45/day
5. Repairs to Equipment (Estimated)		
Engine	$ 20/day	$ 15/day
Drawworks	$ 25/day	$ 20/day
Pumps	$ 20/day	$ 20/day
Miscl. Repair	$ 50/day	$ 35/day
Wire Line	$ 15/day	$ 10/day
Supplies	$ 20/day	$ 15/day
Welding	$ 15/day	$ 10/day
	$165/day	$125/day
6. Drill Collar Depreciation	.....	.....
7. Oil and Grease	$ 20/day	$ 15/day
8. Overhead	$ 35/day	$ 35/day
9. TOTAL	$850/day	$580/day

RIGGING UP COSTS**

CHARGES	CONVENTIONAL RIG	SLIM HOLE RIG
1 Cost of Earthen Pits and Clearing Location	$ 350	$ 300
2. Trucking for Moving, Rigging Up, Rig and Pipe a distance of 150 miles	$5000	$1000
3. Cost of Labor Supplies	Based on 5 man crews $450/day x 3 days rig up $1350	Based on 4 man crews $400/day x 1 day rig up $ 400
	$6700	$1700

This $5000 difference in rigup time means that the big rig must drill the well in eight less days to pay out—compared to the smaller slim hole rig.

TOTAL COSTS OF THE WELL Big Rig	TOTAL COSTS OF THE WELL Little Rig
Total Cost = Rig Up Cost + Number of Days (Daily Operating Costs) + Profit*	
Total Cost = 6700 + 850X + Profit	Total Cost = 1700 ÷ 580Y + Profit*
where X = days for large rig	where Y = days for small rig

By equating the cost equations we find:
If the large rig can drill the well in 10 days—the small rig could take 23 days approximately.
If the large rig can drill the well in 30 days—the small rig could take 53 days approximately.

* Note the profit is not included in the calculation.
** For the benefit of those who like to look at cost figures, WORLD OIL presents this hypothetical Cost Comparison. All charges are estimated.

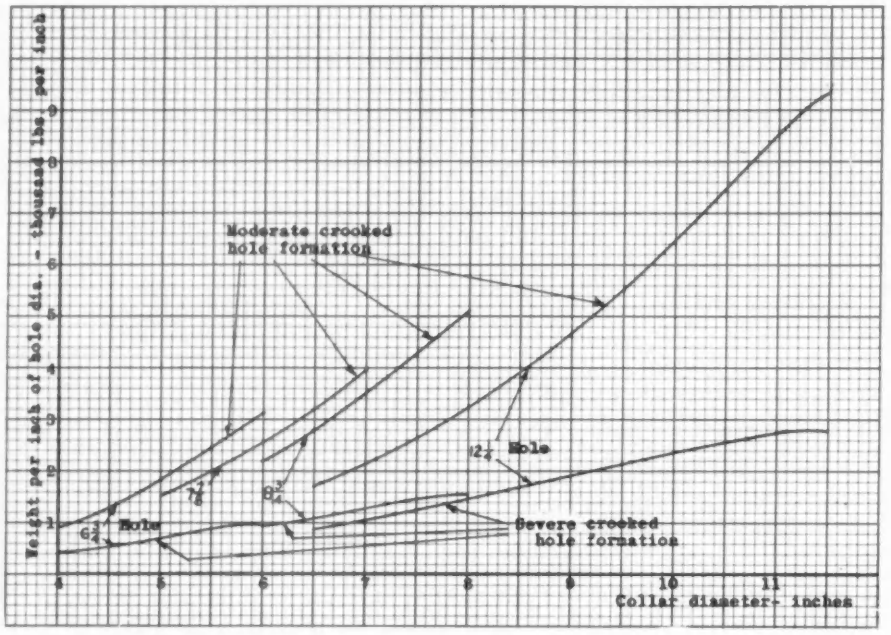
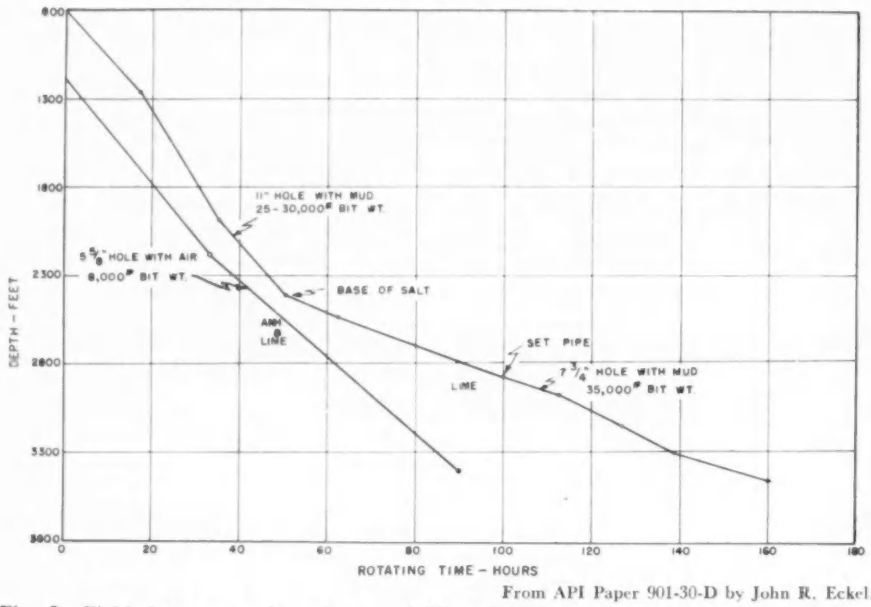

Weight per inch of hole dia. - thousand lbs. per inch
Moderate crooked hole formation
Severe crooked hole formation
Hole
Hole
Collar diameter- inches

Fig. 4—Weight per inch of hole diameter to maintain three-degree hole inclination for different hole sizes and collar sizes.



From API Paper 901-30-D by John R. Eckel.

Fig. 5—Field data comparing air as a drilling fluid in a slim hole to mud used in a conventional hole.

pany recently presented a curve before the API Drilling Practice Group in Midland, Texas, which indicates the tendency of a slim hole to deviate. The weight per inch of bit diameter as shown in Figure 4 is a measure of drilling rate and is plotted against collar diameters for various hole sizes and for moderate and severe crooked hole formations.

"For example, if a three-degree hole could be maintained with 3100 pounds per inch on six-inch collars in a 6¾-inch hole the same angle could be maintained with 5100 pounds per inch with eight-inch collars in a 8¾-inch hole or 9000 pounds per inch with 11¼-inch collars in a 12¼-inch hole. In other words the weight per inch of hole diameter could be made 60 percent greater in an 8¾-inch hole or 190 percent greater in a 12¼-inch hole as compared to a 6¾-inch hole under mild crooked hole conditions. It may be shown that this ratio is the same under severe and mild crooked hole conditions for both 3-degree and 7-degree holes."

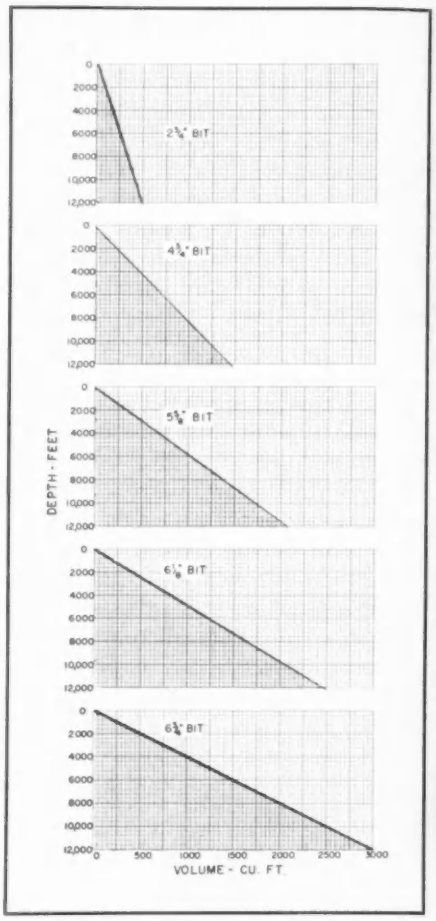


Fig. 6—Volumes of earth removed by various sizes of bits at various depths.

Q *What will be the straight hole problems?*

A The problem of maintaining a straight hole should not be any more difficult in the small hole than in the larger diameter holes. If a well planned drilling program is followed, the vertical deviation should be controlled. The same straightening devices apply to big holes as to small holes.

Q *How much will trip time contribute to the economics?*

A Three main factors to be considered in calculating cost per foot are:

- Rotating time cost.
- Trip time cost.
- Bit cost.

Inasmuch as bit price will decrease as the size decreases, then for a given cost per foot figure, the trip time cost will become greater percentage-wise. This will tend to put more emphasis on footage obtained with a bit in order

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to reduce the number of round trips.

Q *What are the hazards in a slim hole?*

A The hazards of stuck pipe in hole in a slim hole should be no greater than in a larger diameter hole. Adequate circulation to maintain proper removal of the cuttings from the well bore is essential but with the smaller hole and smaller exposed area less sloughing off of the well bore should be expected.

Q *If gas drilling has application for slim hole, what volumes and pressures would be necessary?*

A Since the date of El Paso Natural Gas Company's first gas drilling experiment, 295 wells have been drilled with gas and other operators have drilled approximately 300 more for a total of approximately 600 wells. The following average data have been compiled from their operations. Note that slim hole bits were used.[1]

1. Gas volume used.....2200 mcf/D
2. Gas pressure used.....400 psig
3. Length of time to drill the average footage of 782'/well.....4.6 days or 212 ft./day
4. Drilling time—
   Upper Mesa Verde....4 minutes/foot
   Middle and lower Mesa Verde.....1 minute/foot
5. Footage drilled per bit.....264 feet
6. Weight on bit.....12,000 pounds
7. Size of bits.....Mostly 6¼-inch
8. Maximum footage drilled with one bit .....891 feet
9. Rotary speed.....70 rpm
10. Maximum size hole drilled...11 inches

Using the conventional diamond core barrel and core head the sand members of the Mesa Verde in seven wells have been cored with the following average data:

1. Gas volume used.....2200 mcf/D
2. Gas pressure used.....400 psig
3. Footage cored.....271 feet
4. Coring time.....6 min./ft.
5. Core heads used/well.....1 to 3
6. Weight on core head...17,000 pounds
7. Rotary speed.....40 rpm
8. Size of core head.....6⅛-inch
9. Recovery 85%

Other applications of gas drilling have also been successful such as: (1) milling a window in casing and whipstocking, (2) fishing in open hole and (3) drain hole drilling.

Q *What application will air as drilling medium have for slim hole techniques?*

A The use of air in the slim hole drilling program where applicable should prove beneficial. Where air is used instead of water the circulation cost should be considerably less, and less emphasis would have to be placed on losses within the system.

Q *Can you give information on air drilling, penetration rates, using 6¾ to 4¾-inch bits, weights used, compared to conventional mud drilling in similar sizes and larger size bits?*

A The drilling rates when air is used is increased by 50 percent at least and in some instances by several hundred percent over rates where water is used. The effect of the medium is dependent upon the amount of energy supplied and upon its effective utilization in the well bore. The drilling weights need not be as great with air as a medium, because the formation loosened by the cutting elements of the bit are quickly removed from bottom and are not recut. The lack of a high hydrostatic head on the formation also changes the drilling characteristics of the formation and results in a more rapid rate of penetration.

Humble Oil & Refining Company recently reported field data comparing air and mud as drilling media in Lea County, N. M. See Fig. 5.

One well was drilled with 11-inch bits and carried 30,000 pounds bit weight with mud. Pipe was set in a 7¾-inch; bit was used to total depth using 3500-pound weight. This well took 160 hours rotating time. A nearby offset was drilled slim hole using 5⅝-inch bits with air as drilling medium with only 8000 pounds bit weight. The air-drilled well had penetration rates which almost doubled the other well and used nine less bits to drill a comparable section in the offset well.

REFERENCE

[1] Taken from a paper presented by W. T. Hollis of El Paso Natural Gas Company at American Gas Association meeting, March 5, 1954, in New Orleans.

Popular Size Wash Pipe

O.D. SIZE	Type Joint	Wt./Ft. In Pounds	I.D. Inches
2⅞"	Flush Joint	6.25	2.156
3½"	Flush Joint	10.20	2.922
4"	Flush Joint	11.60	3.428
4½"	Flush Joint	16.60	3.826
5"	Flush Joint	18.00	4.276
5"	Flush Joint	15.00	4.408
5"	Streamline	15.00	4.408EU
5½"	Flush Joint	17.00	4.892

How Deep Can Slim Hole Go?

Here's a Sample Calculation

1. Hole Size 6⅝ Inches.
2. Tool Joint Connection—3½ Inches FH.
3. Drill Collar Length—300 Feet.
4. Drill Collar ID—1¾ Inches.
5. Drill Pipe Size—3½ Inches.
6. Weight Per Foot—15.5 Pounds.
7. Mud Weight—11 Pounds per Gallon.
8. Mud Viscosity—High.
9. Pump—7¾ x 18—24 SPM.
10. Desired Return Annulus Velocity—165 Feet Per Minute.
11. Pump Output—210 gpm.
12. Pump Liner ID to Give Item No. 11—6½ Inches.
13. Jet Nozzle Area to Give 150 Foot/Seconds—.450 Square Inches.
14. Bit Nozzle Pressure Drop—210 psi.
15. Surface Equipment Pressure Drop—15 psi.
16. Drill Collar Pressure Drop—96 Per 100 Feet.
17. Total Drill Collar Pressure Drop—288 psi. (Item No. 3 Times Item No. 16).
18. Total Pressure Drop (Items 14 + 15 + 17)—513 psi.
19. Maximum Discharge Pressure Allowed—2400 psi.
20. Pressure Drop Available—1887 psi (Item No. 19 Minus Item No. 18).
21. Drill Pipe Pressure Drop—145 Per 1000 Feet.
22. Annulus Return Pressure Drop—30 Per 1000 Feet.
23. Total Pressure Drop-175 Per 1000 Feet (Item No. 21 Plus Item No. 22).
24. Maximum Depth Possible for Given Conditions—11,000 Feet (Item No. 20 Divided by Item No. 23).

Pressure Loss Per 1000 Feet for the Various Sizes of Drill Pipe

SIZE DRILL PIPE	GALLONS PER MINUTE					
	150	200	250	300	350	400
2⅜" API REG	750 Lbs./Sq. In.	1300 Lbs./Sq. In.	.....	.....	.....	.....
2⅜" IF	350 Lbs./Sq. In.	620 Lbs./Sq. In.	930 Lbs./Sq. In.	1300 Lbs./Sq. In.	.....	.....
2⅞" API REG	280 Lbs./Sq. In.	490 Lbs./Sq. In.	750 Lbs./Sq. In.	1050 Lbs./Sq. In.	1400 Lbs./Sq. In.	.....
2⅞" SIF	160 Lbs./Sq. In.	270 Lbs./Sq. In.	420 Lbs./Sq. In.	595 Lbs./Sq. In.	795 Lbs./Sq. In.	1025 Lbs./Sq. In.
2⅞" IF	150 Lbs./Sq. In.	260 Lbs./Sq. In.	395 Lbs./Sq. In.	565 Lbs./Sq. In.	760 Lbs./Sq. In.	970 Lbs./Sq. In.
3½" API	90 Lbs./Sq. In.	145 Lbs./Sq. In.	215 Lbs./Sq. In.	300 Lbs./Sq. In.	400 Lbs./Sq. In.	515 Lbs./Sq. In.
3½" DSL	70 Lbs./Sq. In.	115 Lbs./Sq. In.	175 Lbs./Sq. In.	245 Lbs./Sq. In.	325 Lbs./Sq. In.	415 Lbs./Sq. In.
3½" FH & SIF	40 Lbs./Sq. In.	70 Lbs./Sq. In.	120 Lbs./Sq. In.	180 Lbs./Sq. In.	235 Lbs./Sq. In.	300 Lbs./Sq. In.
3½" IF	40 Lbs./Sq. In.	70 Lbs./Sq. In.	110 Lbs./Sq. In.	160 Lbs./Sq. In.	220 Lbs./Sq. In.	280 Lbs./Sq. In.
4" FH & IF	10 Lbs./Sq. In.	25 Lbs./Sq. In.	40 Lbs./Sq. In.	60 Lbs./Sq. In.	85 Lbs./Sq. In.	115 Lbs./Sq. In.

—Courtesy Reed Roller Bit Company

Popular Directional Drilling

Whip Stock Specification

Whipstock O.D.	Pick Up Sub O.D. of Shank	Whip Stock I.D.	Pickup Subs O.D. of Lugs	Size Rat Hole Bit	Size Hole to Run In
4¼"	3⅛"	3⅜"	3½"—3⅝"	3¾"	4¾"—5⅛"
5¼"	3⅛" & 3¾"	4"	4⅛"—4¼"	4½"—4¾"	5⅜"—6¾"
6¼"	3¾" & 4¼"	4½"	4⅝"—4¾"	5¼"—5⅝"	6¾"—7⅞"
Knuckle Joint Slim Joint:					
3⅝"	.....	9/16"	.....	.....	4¼"—4¾"

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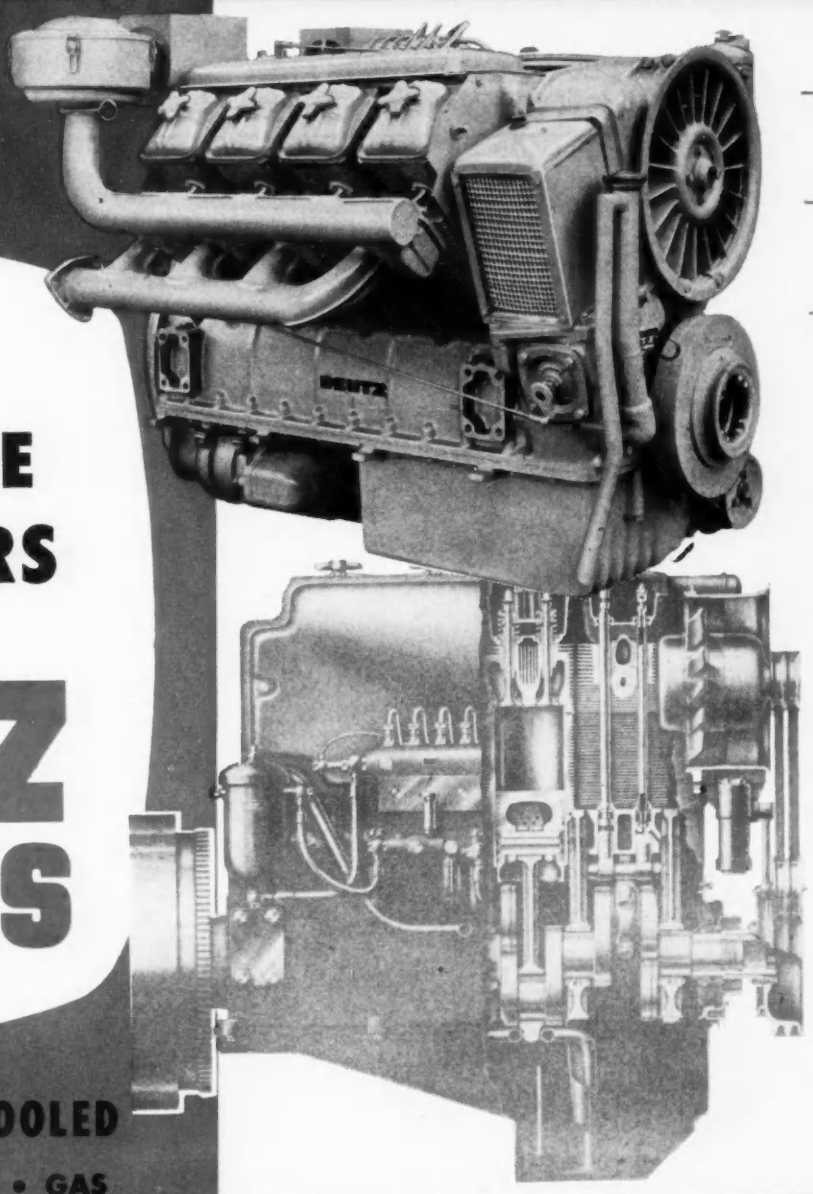

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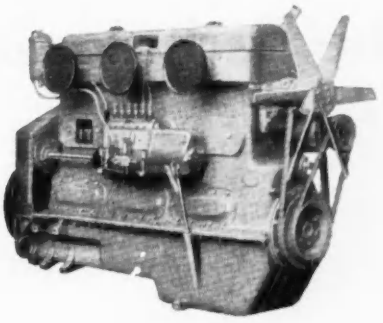

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A Special Report on Slim Hole Drilling

By J. B. MARTIN,
Manager Core Drilling,
Joy Manufacturing Company,
Michigan City, Ind.

ONE-MAN CREW! What drilling contractor wouldn't envy this? This rig costs less than $3000 and has a capacity of 500 feet through medium hard rock.

Mining Industry Has Used The Technique Since 1875

• A comparison of equipment, capital investments, costs, and rates of penetration.

• A description of diamond core drill machines, drilling tools, operating techniques, hole diameters and depths.

SLIM HOLE drilling in the oil industry is becoming increasingly interesting as new methods and techniques applicable to oil field drilling are developed. The slim hole idea is, however, not new, as small diameter holes have been drilled in the mining industry since 1875. By oil field standards, these small diameter diamond drill holes may well be styled "ultra slim holes." Here are some brief descriptions of diamond core drill machines, drilling tools, operating techniques, hole diameters and depths.

Machines and Tools. A typical core drill machine consists of a drawworks for handling drill pipe or drill rods in and out of the hole, a combination means for rotating and applying pressure to the drill rods and a prime mover or power unit. These components are commonly mounted on either a steel skid mounting or an automotive truck.

Combination rotary pressure applying mechanism is either a twin hydraulic cylinder swivelhead or a mechanical screwfeed swivelhead. In either case, the swivelhead serves to both apply pressure and rotate the rods.

The commonly used power units are gasoline engines, diesel engines, air engines or electric motors.

Normally, five sizes of core drills, ranging from small drills for shallow drilling to the largest drills for deep drilling, are used.

Auxiliary equipment or tools consists of a water pumping unit, a mast or derrick, drill rod clamp, waterswivel, drill rods, core barrels, diamond set bits, diamond set reaming shells and casing.

Four standardized sizes of drill rods, core barrels, bits and casing are in common use.

Drill Rods. Core drill rods are made from solid drawn hollow steel tubing having internal upset ends. Each end is internally square threaded and rods

Editor's Note: Due to extreme differences in drilling conditions in the mining industry compared to the oil industry, cost per foot, capital investments in drilling equipment and rates of penetration are difficult to pin point. This comes about because the mining industry's drilling is mostly through metamorphic and igneous rock. Because some oil men feel that tomorrow's slim hole rig will be a compromise between a diamond core drill machine and a conventional oil industry rig, WORLD OIL presents this review by a mining industry expert.

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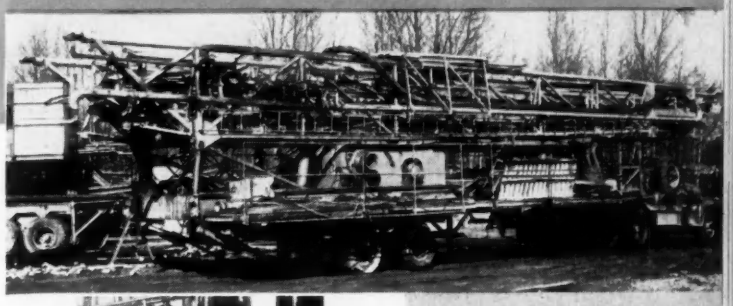
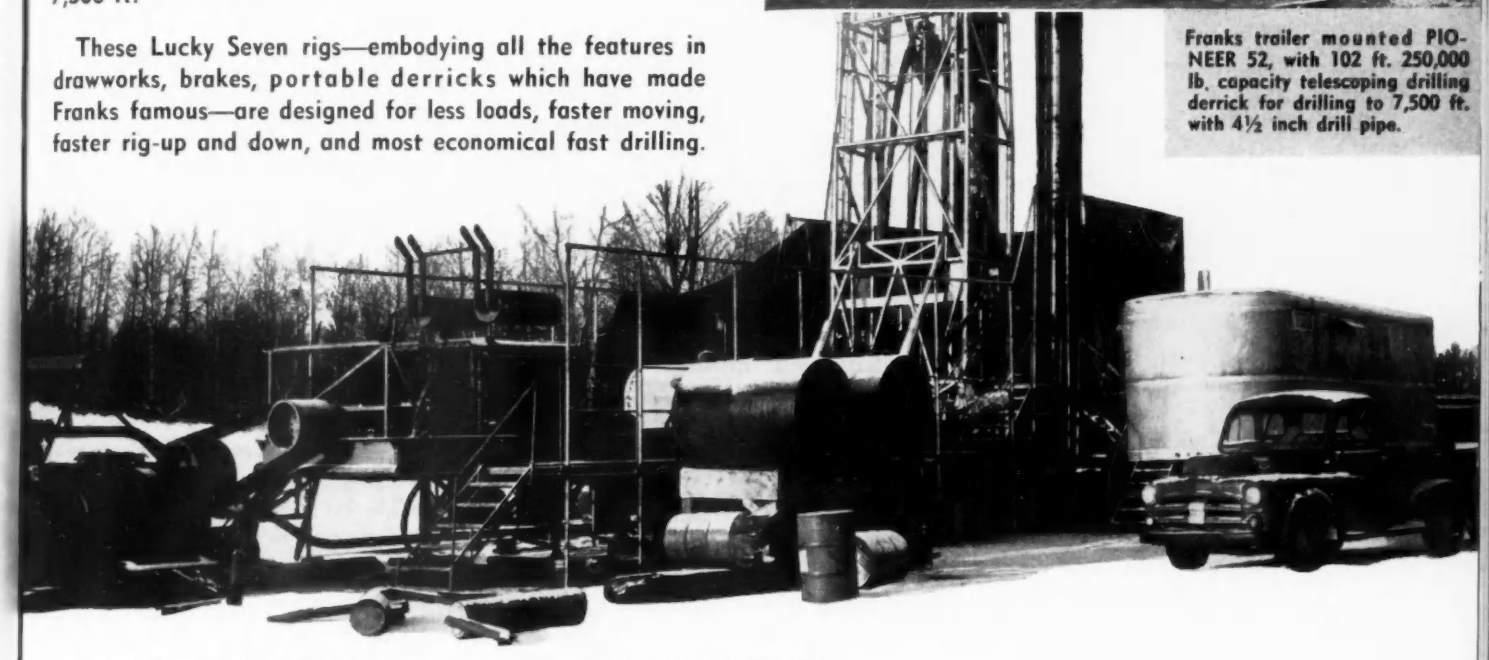


Franks trailer mounted PIONEER 52, with 102 ft. 250,000 lb. capacity telescoping drilling derrick for drilling to 7,500 ft. with 4½ inch drill pipe.

Franks, the manufacturer credited with putting the drilling division of the oil industry on wheels, announces 7 completely new rigs—skid, truck, and trailer mounted—for drilling to 7,500 ft.

These Lucky Seven rigs—embodying all the features in drawworks, brakes, portable derricks which have made Franks famous—are designed for less loads, faster moving, faster rig-up and down, and most economical fast drilling.



STAR FEATURES OF PIONEER 52

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- ★ Pump drive from compound.
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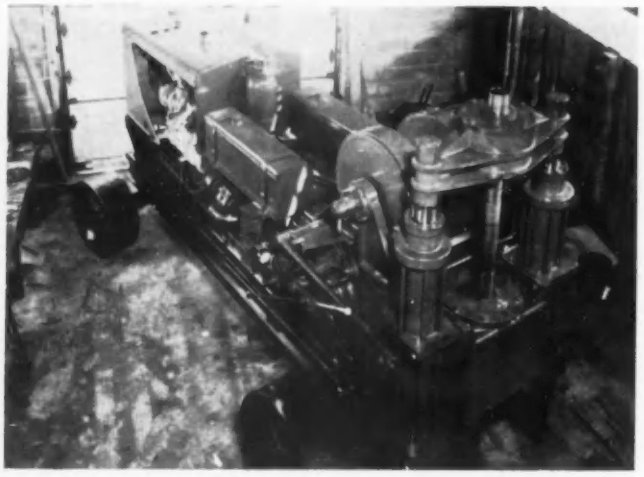
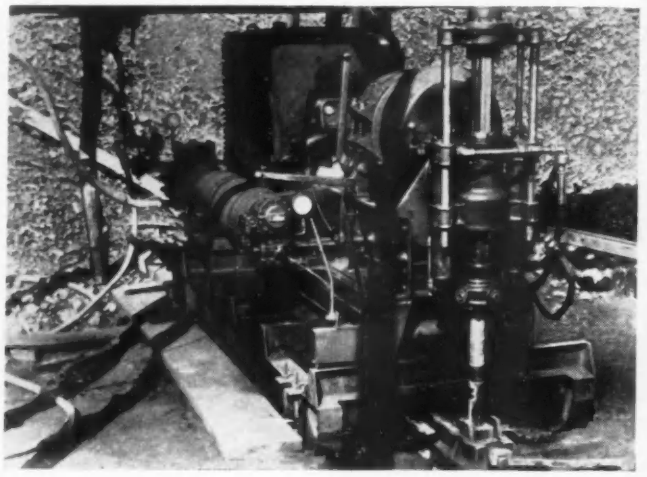


THIS RIG COSTS $55,000 and is similar to the type of rig that drilled 10,718 feet in Africa.



DRILLING END of a core hole rig designed for 2000-foot drilling, showing hydraulic bit loading device.

are coupled by short couplings having square thread pin on each end. (See Table 1).

Both single tube and double tube core barrels are employed with the double tube predominating.

Small industrial diamonds are used almost exclusively as cutting media. Diamonds are mechanically set in the bits and the reaming shells.

The reaming shell connects between the bit and the core barrel and serves to maintain hole gauge.

TABLE 1

TYPE	Outside Diameter	Length	Weight Per Foot, Lbs.
E	$1\frac{13}{16}$	2'-5'-10'	2.7
A	$1\frac{41}{64}$	2'-5'-10'	3.3
B	$1\frac{29}{32}$	2'-5'-10'-20'	4.5
N	$2\frac{3}{8}$	2'-5'-10'-20'	4.9

CORE BARRELS—DOUBLE TUBE

TYPE	O.D. Barrel	I.D. Inner Tube	Length
EX	$1\frac{13}{16}$	$\frac{29}{32}$	5'-10'
AX	$1\frac{27}{32}$	$1\frac{1}{4}$	5'-10'-20'
BX	$2\frac{9}{32}$	$1\frac{23}{32}$	5'-10'-20'
NX	$2\frac{29}{32}$	$2\frac{1}{4}$	5'-10'-20'

BITS BEFORE DIAMONDS ARE SET

	O.D.	I.D.
EX	$1\frac{7}{16}$	$\frac{7}{8}$
AX	$1\frac{27}{32}$	$1\frac{7}{32}$
BX	$2\frac{5}{16}$	$1\frac{5}{8}$
NX	$2\frac{13}{16}$	$2\frac{1}{8}$

Diamond clearance ranges between $\frac{1}{64}$" and $\frac{1}{32}$".

CASING

Casing in square thread flush coupled.

TYPE	O.D.	I.D. Coupling	Length	Weight per Foot, Lbs.
EX	$1\frac{13}{32}$	$1\frac{1}{2}$	2'-5'-10'	1.8
AX	$2\frac{1}{4}$	$1\frac{29}{32}$	2'-5'-10'	2.9
BX	$2\frac{7}{8}$	$2\frac{5}{8}$	2'-5'-10'	5.7
NX	$3\frac{1}{2}$	3	2'-5'-10'-20'	7.8

All of above dimensions are nominal.

Operating Procedure. As core drills are employed on a variety of unrelated applications, and as operating procedure varies with the different applications, this article will deal only with procedure in the mining industry.

Core drilling in the mining industry is divided into two major classifications identified as underground or in the mine drilling and drilling from the surface.

Underground drilling, holes are drilled at any angle of the 360°. On surface drilling, holes range from vertical to about 70° from vertical.

The general procedure on either underground or surface drilling of handling of drill rods in and out of the hole, circulating fluid through drill rods and bit, rotating the rods and applying pressure to the bit is similar to the procedure followed in drilling for oil. Clear water is used for circulation in core drill work, and it is rarely necessary to employ mud fluid. In some cases, on shallow drilling, compressed air is used instead of water.

Core drilling from surface presents many complications not associated with underground work. These emanate from the depth and character of the burden or drift overlying the rock, the ruggedness of the surface, the greater depth of surface drill holes, the remoteness of the drilling location and the availability of water.

The selection of size and type of machine depends upon desired hole depth and surface conditions at any specific drilling location. In places where there exists heavy drift or burden over the rock, drive pipe and wash boring methods are employed, and this unconsolidated formation is cased off to the top of the rock. When the burden consists of clay or silt, or other soft material, drag bits are used to drill the hole large enough to accommodate the casing.

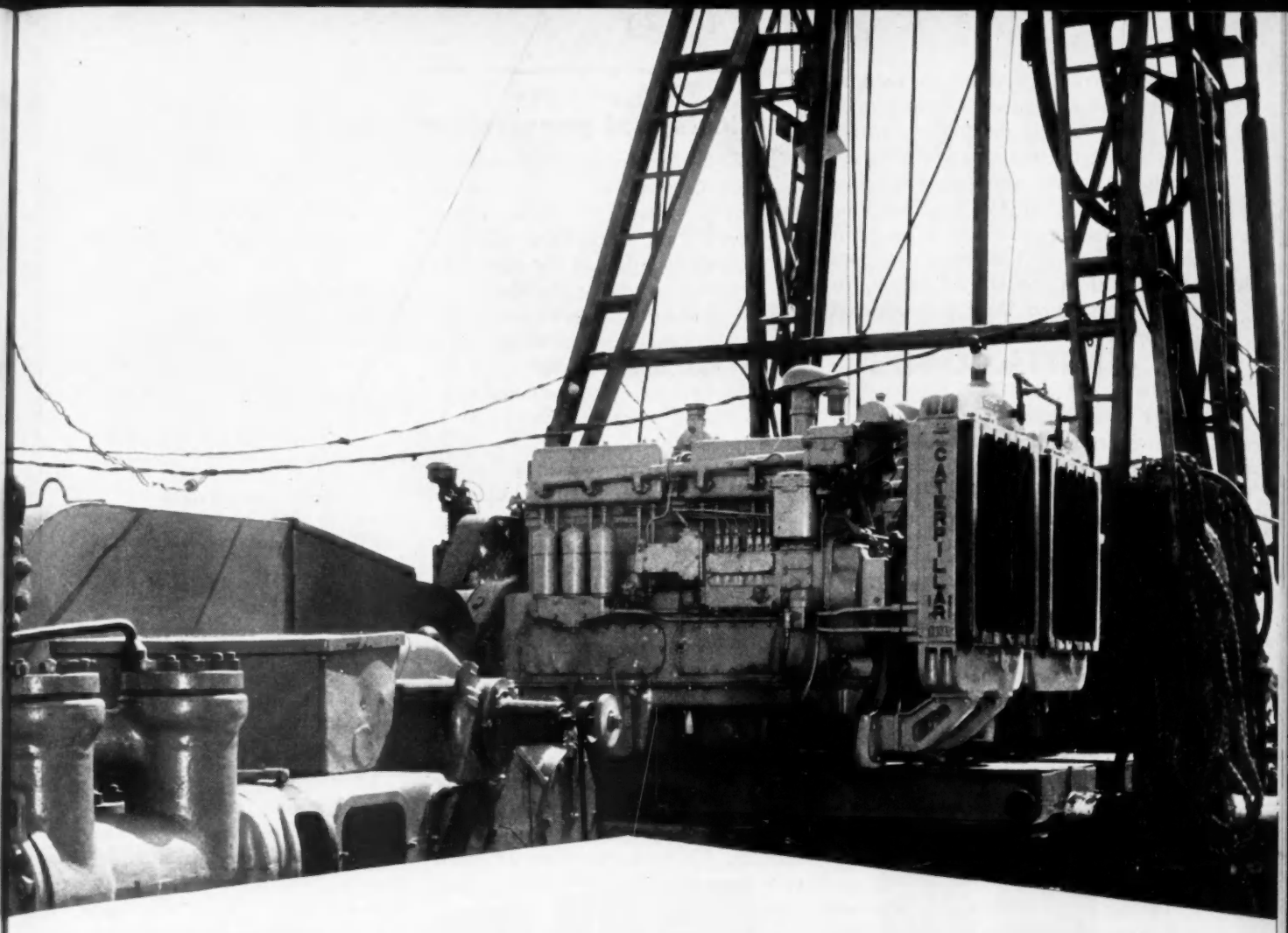
Ordinary black iron coupled pipe is used for casing through the overburden except where heavy boulders are embedded in the burden. In these cases, extra heavy steel drive pipe is used.

After casing is set on the rock, core drilling using diamond set bits commences. The size of core tools depends upon the desired depth of hole and the character of rock formation to be penetrated. If the formation is known to be badly fractured, it is common practice to use NX tools at the start, and when necessary as a result of caving, BX casing is set and drilling commences with BX tools. When further difficulties are encountered, AX casing is set and AX tools employed.

Where this procedure is followed, reaming is unnecessary, as for example, NX tools drill a hole large enough to accommodate BX casing. BX tools work inside the BX casing and drill a hole large enough to accommodate AX casing, and so on.

Where the rock is known to be reasonably solid and not softer than medium limestone, AX tools are used to depths not exceeding 3000 feet. For deeper holes under the same conditions to depths down to 10,000 feet, BX fittings are indicated.

When it is known that drilling will be done through weaker sediments,



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such as shale, NX tools are used to depths not normally exceeding 3000 feet. When deeper drilling is contemplated, through shale, larger tools are employed at the start of hole, thus making provision for at least one string of casing, and in some cases in shale drilling, it is necessary to plan on more than one size of casing. In these cases, mud fluid is employed instead of clear water.

In relatively shallow drilling, to depths of 800 or 1000 feet, ten-foot length core barrels are used. When drilling deeper holes, the use of 20-foot core barrels is more economical, and on very deep drilling, 4000 feet and deeper, sectional single tube core barrels, having an over-all length of 60 feet are used.

When drilling core holes below a depth of 1000 feet, it is usually a requirement to keep the hole advancing within a few degrees of the original alignment. To accomplish this, it is necessary to survey the hole for directional deflection each 25, 50 or 100 feet of advance. At each point where the hole has deflected as much as two degrees, a directional wedge is set and the hole straightened back to about its original alignment.

Taking into consideration all core drill work throughout the world, the greatest percentage of holes are drilled to depths less than 2000 feet. Each year a number of holes are drilled in various parts of the world to depths between 2000 and 3500 feet. Many of these deeper holes have been drilled in northeastern U. S. and on the Iron Ranges of Michigan.

World's Deepest Diamond Drill Hole. About the middle thirties, very deep drilling commenced in the gold fields of South Africa, and this deep drilling has continued up until the present time. These holes are drilled to depths between 4000 and 9000 feet.

One hole drilled in this field during 1936 and 1937 reached a total depth of 10,718 feet, and constitutes the world's deepest diamond drill hole. The well was drilled with a 50 horsepower diesel engine and took about 600 days to drill. A separate gasoline engine drove the 4-inch by 5-inch circulating pump.

This deepest core drill hole was drilled with a 5-inch diameter bit to a depth of 226 feet, where 3-inch inside diameter casing was set. Drilling continued from this point using NX tools, removing 2-inch diameter core to 900 feet, where BX casing was set. BX tools removing 1¾-inch core were used from 900 feet to completion of hole at 10,718 feet.

Deflection Tests. The hole deflection record on the world's deepest diamond core hole is presented below:

2° at 1000 ft.	2° at 7000 ft.
5° at 3000 ft.	32° at 9000 ft.
3° at 5000 ft.	(deflected)
	44° at 10,500 ft.

The formation penetrated in this deep hole consisted of:

0 to 6300 ft.—Dolomite and chert; 6300 to 10,700 ft.—Bird series metamorphic rock; 10,700 to 10,718 ft.—Gold vein quartz and schist.

On the world's deepest core hole, three shifts per day were run. The crew consisted of one general foreman, two white drillers, and two native laborers each shift.

Close Tolerances in Mining Drilling. The very small diameter of core drill tools and the close clearances between the tools and casing and between casing and walls of hole are made necessary by the very high cost of diamonds used as cutting media.

The largest single item of cost of core drilling is skilled and unskilled labor, and the number two item is usually diamond cost per foot of drilling, which in some cases closely approaches the labor cost.

These small diameters and close clearances are made possible by the fact that in core drilling in the mining industry, the drilling is done largely through metamorphic, igneous and the harder, more solid sedimentary rocks. These rocks are not soluble in water and do not disintegrate by air contact. Holes drilled through formation of this kind do not whip out, and when caving becomes troublesome, it can usually be stopped by cement injection, except in cases where the formation is very badly fractured, making casing a necessity.

When drilling holes less than 2000 feet, a shift crew consists of one driller and one helper. When deeper holes are drilled, the crew consists of one driller and two helpers.

As a general rule, core drill machines are operated on one or two shifts per calendar day. It is rather uncommon to operate on a three shift basis.

It will be noted that fundamentally, the drilling procedure in core drilling in the mining industry is quite similar to the procedure followed in the oil field drilling except for size of tools and type of bits. It is also obvious that these small diameter diamond drill tools cannot be successfully drilled in oil field formation, which consists for the most part of relatively young, weak sediments.

Costs and penetration rates . . .

Cost per foot and penetration rate are extremely variable due to variation in the rock characteristics, surface conditions, depth of hole and the nature of burden overlying the rock.

It is accordingly impossible to state specific costs except for a specific condition; however, the following average costs and penetration rates may be of some interest.

The above cost includes depreciation on capital, but does not include contractor's profit or transportation expense.

Capital Investment

The tabulation set out here shows the approximate cost of different sizes of drill machines and operating equipment for drilling to the depths indicated.

Footage Costs and Rates

ROCK	Size Tools	Penetration Rate Feet per Hour	Total Cost per Foot
Medium.....	EX	7 feet	$1.50
Hard Rock	AX	8 feet	1.55
	BX	9 feet	1.60
	NX	10 feet	1.70
Hard Igneous Rock.....	EX	3 feet	2.20
	AX	3 feet	2.35
	BX	4 feet	2.60
	NX	4 feet	3.25

Capital Investments

Depth of Hole	Size of Tools	Total Cost of Rig
700 ft.....	EX—AX	$ 3,000
1500 ft.....	EX—AX	7,000
2500 ft.....	EX—AX	11,000
2500 ft.....	BX—NX	13,000
4000 ft.....	BX	27,500
6000 ft.....	BX	32,000
10000 ft.....	BX	55,000

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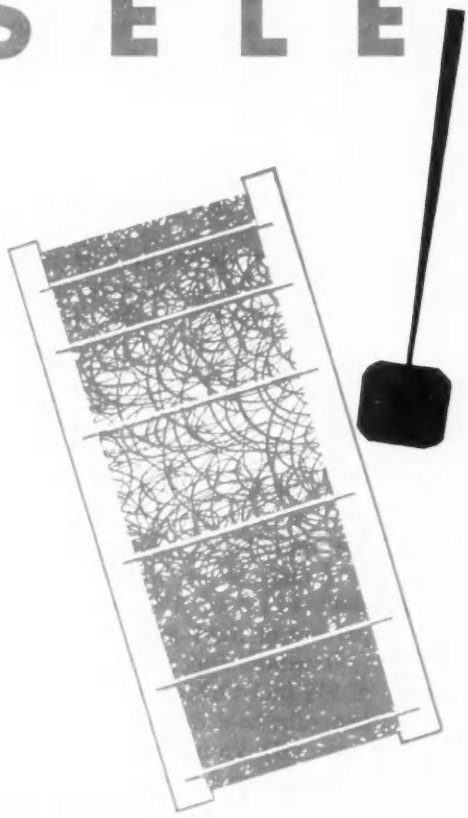

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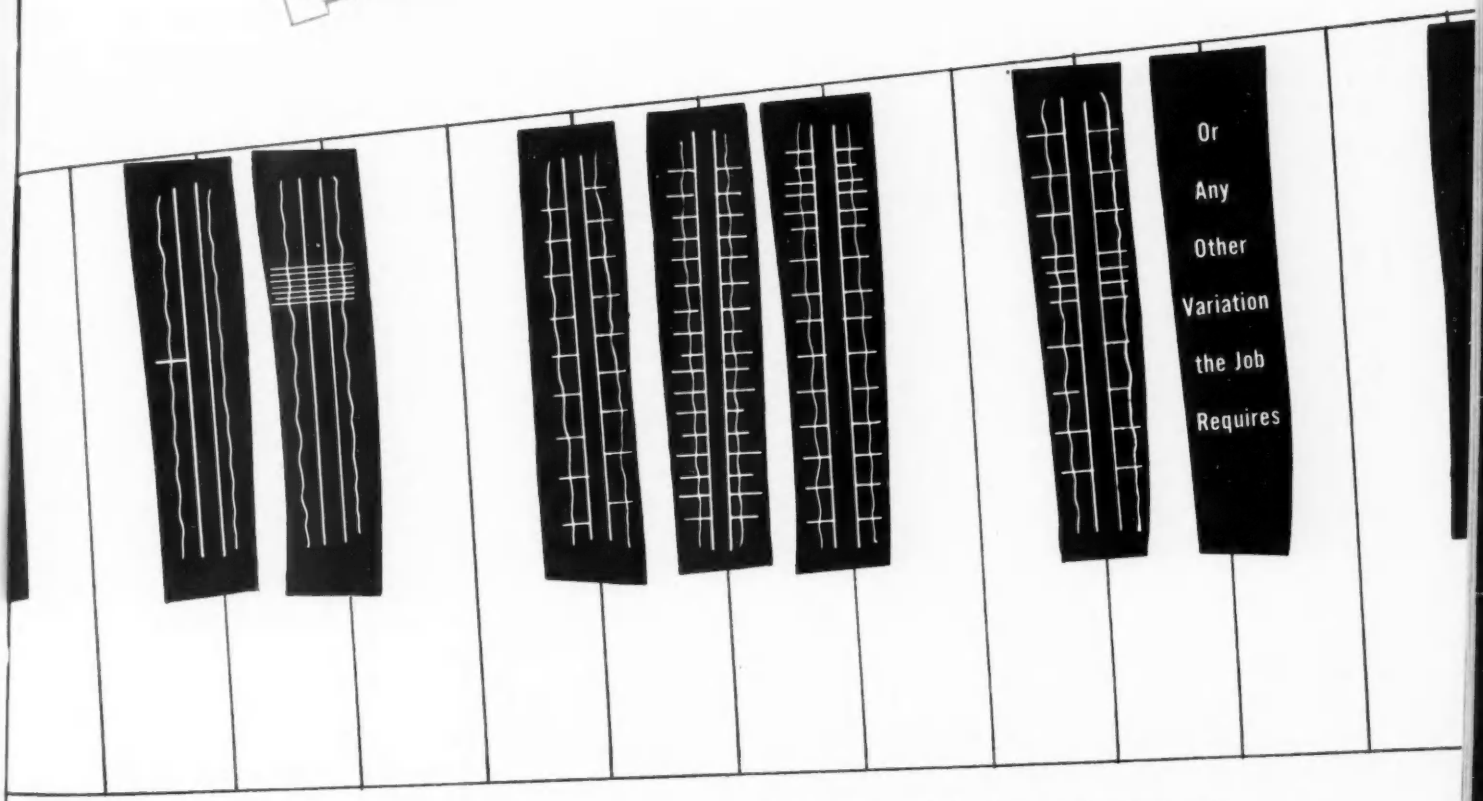

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• He gives the findings of an actual experiment to appraise methods.

• He lists seven big problems using today's equipment and suggests solutions.

• He estimates hoisting and circulating requirements for 12,000-foot drilling.

• He concludes that economics is the only advantage.

By G. C. MacDONALD, Division Drilling Engineer,
Gulf Oil Corporation, Tulsa Production Division

A SLIM HOLE is intended to provide a bore hole to a given depth at a lower total cost than is possible with a conventional hole. There is no mechanical advantage in the reduced hole diameter. In fact, there are some distinct disadvantages; the only advantage is economic. The reduced drilling costs are not the result of reduced drilling time; in fact, the rate of forward progress is generally slower as the hole size is reduced. Cost reduction is achieved by using smaller equipment and smaller crews, resulting in lowered investment, moving, maintenance, fuel and labor costs. If lowered total drilling costs are to be achieved, drilling time cannot be permitted to increase sufficiently to nullify the reduction in daily operating costs. Increased drilling costs would result if standard size rigs were used to drill small holes.

The slim hole drilling technique today is almost exclusively an exploratory drilling tool. It is intended to reduce the cost of dry wildcat wells. The desirability of a slim hole increases as the prospects of a dry hole increase. An expectancy ratio of one producing well to every nine wildcats drilled is common to the industry and if the eight dry holes can be drilled at savings sufficient to offset the added costs of the one producer, then the total drilling cost of the nine wells will be reduced.

The ultimate objective of slim hole drilling would be to reduce costs sufficiently to make it economical to plug immediately an oil or gas discovery well. A standard size rig would then be employed for development drilling. Alternatives to plugging would be to run small diameter casing or ream the hole for normal size casing.

Slim hole defined. The term slim hole should connote some other than routine hole size. A 5½-inch outside diameter oil string is quite common; during the past eight years (including 1952) 27.145 percent of the tonnage of all casing, tubing and drill pipe shipped from mills has been 5½-inch OD. During the same period, 7-inch OD has constituted 33.756 percent of the total. An approximate conversion of tonnage to feet would indicate that the footage of 5½-inch OD is 120 percent of the 7-inch OD footage.

It would appear that the running of 5½-inch OD is normal and routine; hence, a hole drilled to receive 5½-inch OD casing is a conventional hole. A slim hole should be smaller. For the present, a slim hole may be defined as a drilled hole too small to receive 5½-inch OD casing.

A Slim Hole Drilling Experiment . . .

A slim hole drilling experiment was carried out in CPR Schultz 6, an exploratory well approximately 40 miles northwest of Stettler, Alberta, Canada. A slim hole was drilled to 6000 feet and abandoned as dry. The well reached total depth 53 days after spud date, and after velocity surveys, the rig was released on the fifty-seventh day. Two and seven-eighths-inch OD N-80, 6.5 pounds per foot tubing with screwed on tool joints was used to drill a 5⅝-inch hole. Seven and five-eighths-inch OD surface pipe was cemented on bottom in an 11-inch hole, drilled with 4½-inch OD drill pipe, at 603 feet with 325 sacks common cement. The plug was drilled and new hole made with a 6¾-inch bit to 800 feet where the hole size was reduced to 5⅝ inches. Two diamond cores cut 33 feet and of the six drill stem tests taken, the first two failed to maintain a packer seal.

The rig drawworks was a double drum hoist powered by a twin diesel driving through a torque converter. A 14-inch pump was independently driven by a twin diesel without torque converter. The drawworks, engine and telescoping doubles mast were mounted on a dual tandem trailer. A separate steel substructure supported the floor, rotary table and drill pipe while it was out of the hole. One 200-barrel rectangular skid-mounted steel mud pit was used.

Tubing tool joints on tubing used. Two and seven-eighths-inch OD, 6.5 pounds per foot, EUE 8-round thread, N-80 seamless steel tubing with couplings replaced by tubing tool joints, screwed on but not welded, was used as drill pipe. The tool joint was approximately an API 2⅞-inch internal flush; a slightly increased stand off and an increase in bore from 2⅛ inches to $2\frac{7}{16}$ inches were the only differences.

The 4⅛-inch OD tool joints with a $2\frac{7}{16}$-inch bore (2.437 inches) result in range 2 tubing weighing 7.4 pounds per foot compared to ap-

proximately 11.7 pounds per foot for 2⅞-inch OD drill pipe with tool joints. In addition to reduced hoisting loads when tubing is used as drill pipe, circulating pressures are reduced when 2 7/16-inch bore tool joints are used instead of 2⅛-inch bore API internal flush joints. The pin end of the tubing tool joint is somewhat weaker because of its larger bore but no trouble developed from that cause. Drill collars were made available from other completed jobs and consisted of:

- 3 4½-inch OD x 1½-inch bore with 3½-inch API Regular Boxes
- 5 4¾-inch OD x 2¼-inch bore with 3½-inch API Full Hole Pin and Box
- 10 4¾-inch OD x 2⅛-inch bore with 3½-inch API Internal Flush Pin and Box

Originally, one 4½-inch by 1½-inch and five 4¾-inch by 2¼-inch collars were run; at 5200 feet the one 4½-inch by 1½-inch collar was replaced by five 4¾-inch by 2⅛-inch collars. The ten collars provided a bit weight of 12,000 pounds in 10.5 pounds per gallon mud. Rock bits were used exclusively, 48 5⅝-inch, one 6¾-inch and one 11-inch, a total of 50 rock bits.

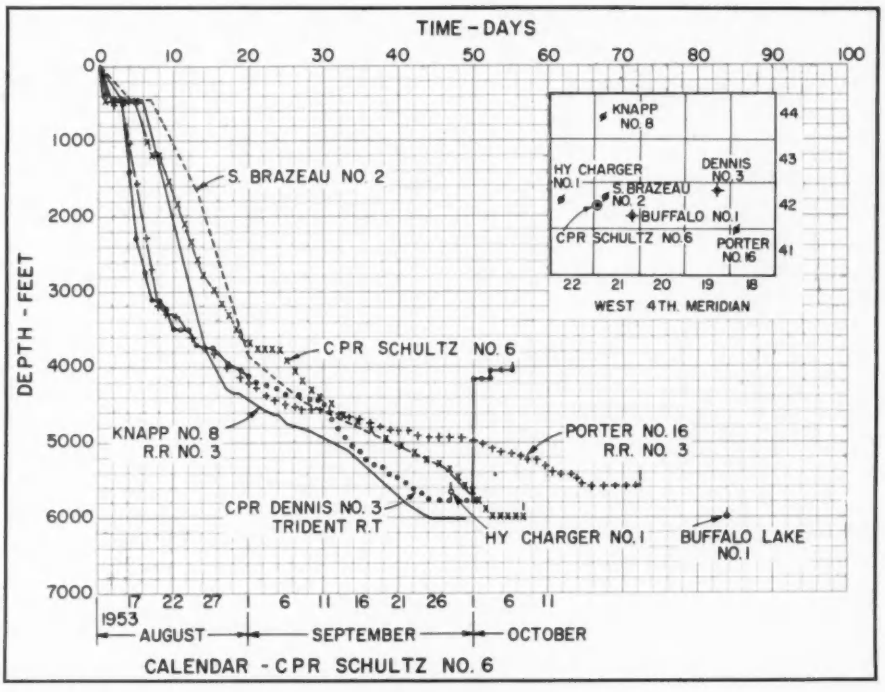
Slim hole fishing tools. Provision for fishing tools required a compromise. A slim hole overshot was provided which was 5⅛-inch OD and was equipped with grapples to catch both 2⅞-inch OD tubing and 4⅛-inch OD tool joints. The 4¾-inch OD drill collars would have been fished, if necessary, by either a releasing spear or a taper tap. A left-hand rotation for release safety joint was on location for use with the taper tap. All fishing tools had a top connection of 2⅞-inch OD API internal flush box and a special sub was on location with a tubing tool joint "box up" and 2⅞-inch OD API, IF "pin down."

Subs were necessary to adapt the tubing tool joints to the kelly and to the drill collars. A top sub with tubing tool joint pin down and 3½-inch OD API full hole box up was provided for connecting drill stem testing surface equipment to the drill pipe.

A tong torque indicator was employed to assure proper makeup in tool joints and drill collars. Drill collars were tightened with 9400 foot pounds of torque and tool joints with 5200 foot pounds. An interesting sidelight developed in that under certain atmospheric conditions, the maximum available line pull from the automatic cathead was barely sufficient to develop 9400 foot pounds. It may be concluded that when larger collars had been used in this rig during conventional drilling, they had not been sufficiently tightened. A torque indicator was used also on the chain driving the rotary table.

Coring was done with a 4¼-inch OD by 50-foot long core barrel with a 5½-inch OD diamond core head cutting a 2⅜-inch diameter core. It was run below all drill collars; circulating 154 gallons per minute on the first core and 164 gallons per minute on the second run. Bit weight was increased to a maximum of 6000 pounds during each core.

Four-man crews were used, each working seven days. Tours were rotated every Saturday.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0 10 20 30 40 50 60 70 80 90 100
DEPTH - FEET
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KNAPP NO. 8
HY CHARGER NO. 1
DENNIS NO. 3
S. BRAZEAU NO. 2
BUFFALO NO. 1
CPR SCHULTZ NO. 6
PORTER NO. 16
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WEST 4TH. MERIDIAN
S. BRAZEAU NO. 2
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KNAPP NO. 8 R.R NO. 3
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CPR DENNIS NO. 3 TRIDENT R.T
HY CHARGER NO. 1
BUFFALO LAKE NO. 1
17 22 27 1 6 11 16 21 26 1 6 11
1953
AUGUST
SEPTEMBER
OCTOBER
CALENDAR - CPR SCHULTZ NO. 6

FIGURE 1.

Mechanical Results . . .

Figure 1, Drilling Time Profile, compares the over-all rate of forward progress with four conventionally-drilled wells in the area. The gross time to total depth is shown for two additional conventionally-drilled wells. Progress on the slim hole was slightly slower from surface pipe (603 feet) to 3000 feet, after which depth the slim hole rate was competitive. Progress to 3000 feet was slow because:

- Rigging up was completed with surface pipe set. Storms and mud completely halted operations for a day and a half.
- Operating technique had to be developed; there was no background of experience to guide the way.
- Tongs would not grip the new tool joints. Round trips at 5000 feet were made in less time than at 3000 feet.
- The rock bits available were not well suited to the upper drilling.

Total depth of 6000 feet was reached on the fifty-third day after spudding and the rig released on the fifty-seventh day. In general, to 5200 feet with six drill collars (7200 pounds), a bit weight of 7000 pounds and a table speed of 170 to 180 revolutions per minute was employed. It was found that the rate of bit-bearing wear was much greater than tooth wear under those conditions. Ten drill collars were then run (12,000

pounds), a bit weight of 12,000 pounds, and a table speed of 110 to 115 rpm used. The bits turned the same number of total revolutions before being pulled but because there was no apparent reduction in rate of penetration with the increased bit weight and slower table, the footage per bit was increased and less time was consumed by trips.

Bits numbers 5 through 10 were jet bits, drilling from 1486 feet to 2915 feet. Formational changes masked results but jets were discontinued because pump pressures were excessive; rates of circulation were progressively reduced from 260 gpm (1320 psi) to 200 gpm (900 psi) until jets were no longer advisable.

Effect of oil in the mud. Stuck pipe at 4564 feet was free in two hours after 32 barrels of crude oil had been spotted around the bit and drill collars. Prior to spotting oil, circulating pressures approximated 1000 psi at 180 gpm. The oil was not removed from the mud and pressures, when drilling was resumed, were initially 700 psi at the same rate of pump revolution; there is no way to meter circulating drilling fluid. Pressures did not again reach 1000 psi until another 1000 feet of hole had been drilled.

High circulating pressure is one slim hole drilling problem and if the addition of oil to a water-base mud will reduce the pressure by one third, the depth range for pumps can be increased substantially. Oil in the mud may be objectionable on wildcat wells; the use of oil-emulsion mud was avoided in CPR Schultz 6 to prevent difficulty in identifying subsurface oil shows.

Circulating pressures near total depth reached 1280 psi; with 5-inch liners the pump would have the gear end overloaded above 1350 psi. One hundred and eighty gallons per minute were being circulated requiring 160 horsepower to the pump pulley and an annular mud return velocity of 183 feet per minute was being developed. The 5-inch liner size had been selected before drilling began to assure a minimum annular velocity of 175 feet per minute to total depth without overloading the pump. Drilling was ended 100 feet above originally proposed total depth and all mechanical demands were satisfied with but a small margin to spare.

Problems and how to solve them . . .

1. Fishing. The problems incident to slim hole drilling were identified; fishing is one. Drill pipe and tool joints can be fished with a slim hole overshot. A 5⅜-inch OD slim hole overshot will fish 4¼-inch OD collars, meaning that no larger than 2⅞-inch connections could be used on the drill collars. The drill collar connections in use in CPR Schultz 6 were 3½-inch FH (4⅝-inch OD) and 3½-inch IF (4¾-inch OD). A 5½-inch OD slim hole overshot will fish 4⅝-inch OD but considerable hazard would be generated by running a 5½-inch OD overshot in the 5⅝-inch hole.

A 5⅝-inch slim hole has subsequently been drilled in Oklahoma with 2⅞-inch IF drill collar connections turned down on each end to 4¼-inch which in one instance permitted fishing with a 5⅜-inch OD overshot.

It is apparent that a hole size reduction from 5⅝-inch to 4¾-inch would eliminate all possibility of overshot fishing; taper taps and releasing spears would be the only usable tools. This is one of the principal deterrents to an immediate acceptance of the many advantages of a 4¾-inch hole.

2. Bits and bearings. The second slim hole drilling problem, and another deterrent to 4¾-inch drilling is the deterioration in rock bit bearings with decrease in bit size. A 5⅝-inch rock bit is the smallest that has standard bearings: nose, roller, and ball bearings. Since bearing failure was the one factor limiting 5⅝-inch bit life, a further reduction in bearing quality, and supposedly bit life, is undesirable. Previous investigators had reported that 4¾-inch bits for medium hard drilling were unsatisfactory; blade bits had been used in soft digging and diamonds in hard digging. A second 5⅝-inch slim hole recently completed in Canada (CPR Kerbes 6) experimented with blade bits, one popular with shot hole drills, but performance was totally unsatisfactory.

The selection of rock bit tooth design is limited even in the 5⅝-inch size. As a result of having to drill formations too soft for effective penetration with available bit tooth design, CPR Schultz 6 could not compete in drilling time to 3000 feet. Beyond that depth it was competitive.

Porter 16 used 29 9-inch rock bits to 5600 feet, Knapp 8 used 28 to 5600 feet and four additional to 6000 feet. Thirty-three 9-inch rock bits would cost (at $173 each) $5709. Forty-eight 5⅝-inch rock bits (at $114.60 each) would cost $5500. Although 15 more small bits were used, the total cost was $200 less.

3. Circulating pressures. The third slim hole drilling problem is high circulating pressure. Horsepower requirements for circulating are not excessive due to relatively low volumes required, but pressures required in slim hole drilling are such that the conventional small pump, adequate for large volume low pressure service, incident to standard hole size drilling with 4½-inch drill pipe to shallow depths, is totally unsuited to slim hole drilling requirements.

The drilling string should be carefully designed to eliminate as many constrictions as possible in order to reduce to a minimum required circulating pressures. The fluid volumes, pressure and horsepower required in several combinations of hole and drill pipe sizes to insure a return fluid annular velocity of 175 feet per minute while circulating a typical mud of 10.5 pounds per gallon and 23 centipoise stormer viscosity or approximately 42 second funnel viscosity with typical drilling strings are shown in Table 1.

Advantages of a 4¾-inch hole drilled with tubing are apparent; pressures are approximately half and

TABLE 1

Requirements for 175 ft/min Annular Velocity

DRILL PIPE O.D.	Hole Size	Gal./ Min.	5,000 FEET		10,000 FEET	
			Pressure Psi	H.P. to Pump	Pressure Psi	H.P. to Pump
4½ in.	9 in.	435	1015	306	1445	436
4½ in.	7⅞ in.	298	525	109	765	158
3½ in.	6¾ in.	238	945	156	1560	258
3½ in.	6¼ in.	192	685	91	1120	149
2⅞ in.	5⅞ in.	188	1120	146	2035	266
2⅞ in.*	5⅝ in.	167	925	107	1700	197
2⅞ in.*	4¾ in.	102	450	32	825	58

* Tubing.

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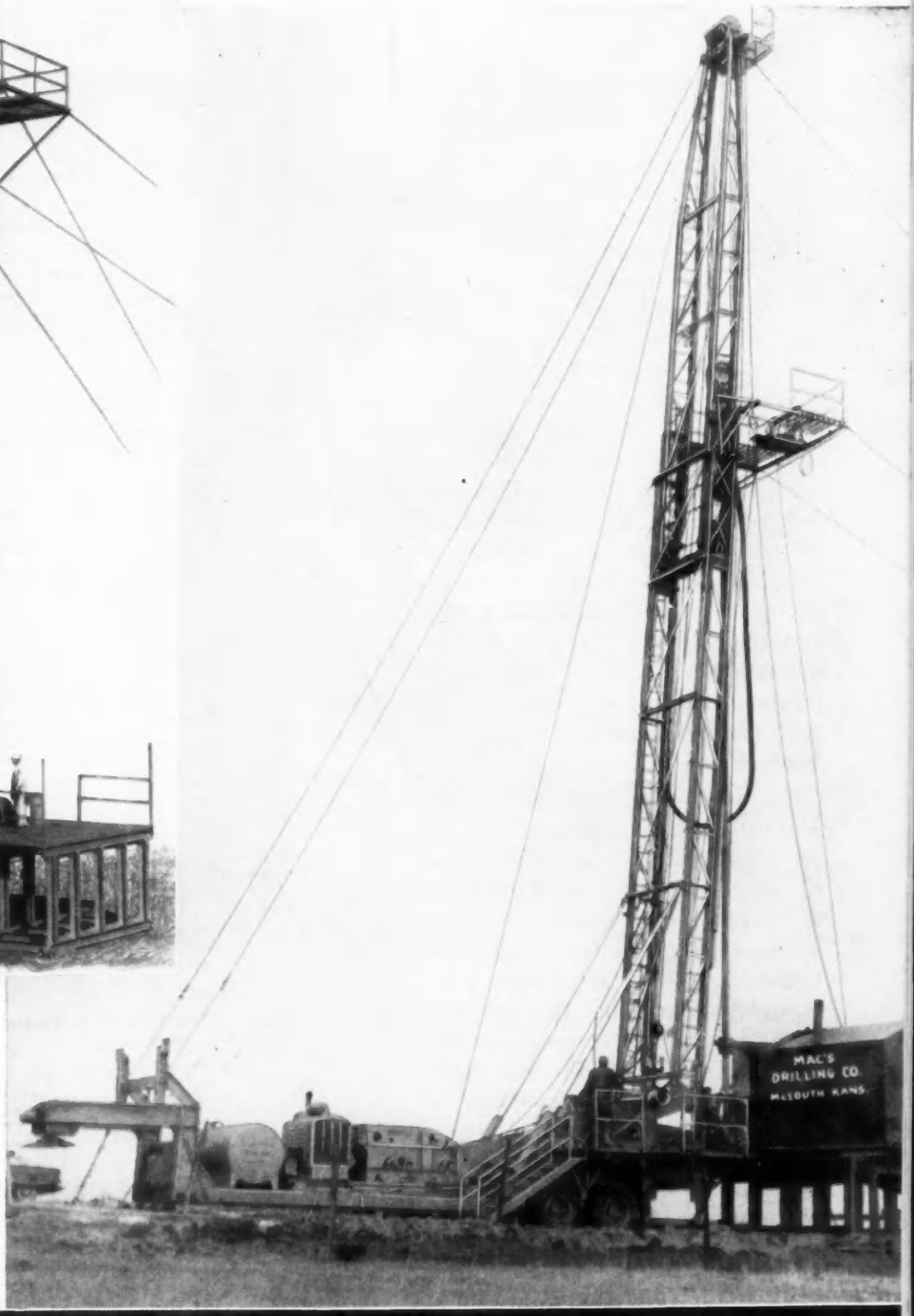

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horsepowers less than one third those required for 5⅞-inch drilling. Circulating tests were conducted on Schultz 6 to determine the portion of the total pressure drop occurring in each segment of the drilling string. Circulating volumes were estimated by assuming the pump 93 percent volumetrically efficient after deducting the volume of the fluid piston rods. The two pressure gauges on the rig were calibrated on a dead weight tester prior to the test. The mud analysis is shown in Table 2.

The results of the tests are shown in Figure 2 which is a plot on log-log paper of circulating pressure versus circulating rate at various depths. At 167 gallons per minute, the rate necessary to develop 175 feet per minute annular mud velocity, the required pressures is shown in Table 3.

The circulating test at 6000 feet was actually made 37 days after the series of tests to a maximum of 3000 feet. There was a slight change in mud properties at the time of the deeper test and 1½-inch bore drill collar has been replaced by five 2⅛-inch bore collars. The results were still consistent. It may be seen that at 167 gallons per minute, 175 feet per minute annular velocity, surface connections, drill collars, bit, float, etc., and return pressure in 186 feet of 6¾-inch hole require 157 psi pump pressure and that the drop through 1000 feet of tubing and return in a 5⅞-inch hole is 155 psi.

On this basis, 10,000 feet of hole would require 1550 psi plus 157 psi for collars and surface, or 1707 psi to circulate. This has been rounded off to 1700 psi for use in Table 1. These values are quite significant and useful because no others are available for tubing-drill pipe which have been obtained under such known conditions. The data are extrapolated subsequently to develop a rig design for deep slim hole drilling.

4. Drill pipe tongs. The fourth problem is the lack of suitable tongs. The 4⅛-inch OD tool joints require small tong heads in conventional short handled rig tongs and these do not grip the tool joints properly, particularly a new joint. This fact accounted for the ability to make round

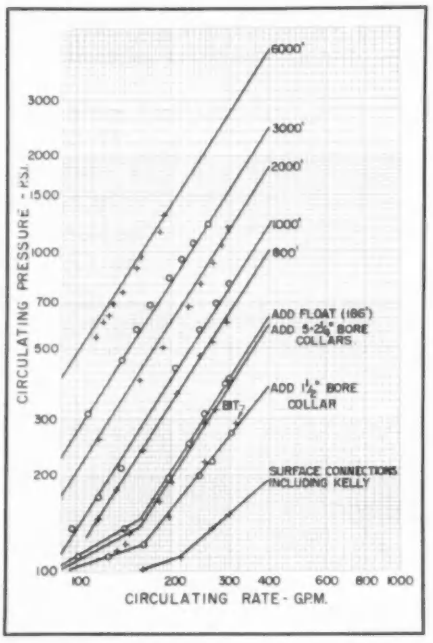

Fig. 2—Circulating pressure vs. circulating rate 2⅞-inch OD tubing; 5⅞-inch hole; mud viscosity 42 seconds, 23 centipoise, 10.5 pounds per gallon; as observed in CPR Schultz 6.

trips at 5000 feet faster than at 3000 feet; by that time the tool joints were roughened up sufficiently to permit the tongs to grip.

Air tongs might be adapted to this use, but the more common air tongs grip the tubing instead of the tool joints and have a torque output of 4500 foot pounds at 120 psi of air. The recommended torque makeup for the tubing tool joints is from 4500 to 6000 foot pounds; 5200 foot pounds were used and a tong torque indicator used on the jerk line at all times to insure proper joint makeup. The 3½-inch drill collar connections were made up to 9400 foot pounds. Air tongs would, therefore, not be usable on drill collars but might be increased in torque output sufficiently to insure adequate tool joint make up and still provide reserve for breaking out the tool joints. If air tongs are used, air slips should be provided, principally to provide backups for the air tongs.

TABLE 2
Mud Properties at Time of Circulation Tests

Weight	10.5 lb./gal.	Calcium	0.0
Viscosity	42 seconds	Sulfate	20
	23 centipoises	Alkalinity	P 0.03
Gel, initial	0 grams		M 0.33
Gel, 10 minute	0 grams	EPM	OH 0
Filtrate	8.4 cc	EPM	CO_3 1.2
Cake	2/32 ins.	EPM	HCO_3 5.4
Sand	0.5 percent		
pH	8.3		
Chlorides	150 ppm		

TABLE 3
Pressure Drop in 5⅞-Inch Hole Through 2⅞-Inch OD Tubing

	Item	Cumulative
Surface connections, including kelly	102 psi	.....
1 30 foot drill collar, 4½ inches O.D. x 1½ inch bore	23 psi	125 psi
5 30-foot drill collars, 4¾ inch O.D. x 2¼ inch bore and 5⅞ inch rock bit with 1½-inch water course	22 psi	147 psi
1 float, total in hole 186 feet	10 psi	157 psi
Add 618.56 feet of tubing, circulate at 800 feet, bottom of 6¾-inch hole	98 psi	255 psi
Add 286.76 feet of tubing, circulate at 1000 feet	50 psi	305 psi
Add 991.11 feet of tubing, circulate at 2000 feet	155 psi	460 psi
Add 990.66 feet of tubing, circulate at 3000 feet	155 psi	615 psi
Circulate at 6000 feet	465 psi	1080 psi

5. Personnel. The fifth problem is personnel. Experienced personnel are often reluctant to work on a slim hole rig. Additional training is necessary for those who will. On the Schultz 6, 16 joints of tubing-drill pipe were kinked on one round trip as a result of setting the pipe too high in the slips. Although the slips were set much lower than they would have been with 4½-inch OD drill pipe, it was still not low enough to protect the tubing from damage. The higher than normal circulating pressures generate a tendency to reduce circulating rates.

There might be merit in a plan to up-grade shot hole drillers rather than use rotary drillers.

6. Special equipment. The sixth problem is special equipment. Nearly every rig is equipped with all the 4½-inch and 3½-inch substitutes, floats, kellies, elevators, slips, etc., required for conventional drilling but the assembling of adequate equipment for slim hole drilling usually involves extensive machine shop work. Fishing tools are not readily available; surface connections for drill stem test equipment require special attention; the mouse-hole pipe must be extended above the derrick floor to permit mouse-hole connections without kinking the single; drill stem testing pipe plugs must be provided to fit the tubing tool joints and smaller rubbers placed in the mud box; in general, slim hole drilling requires a rather complete outfitting in accessories usable only with tubing-drill pipe.

A rig intended solely for slim hole drilling will be properly equipped for that work and not for drilling with 4½-inch OD drill pipe. Since the converse is true, it is often impossible

a TWIST of the wrists

snap-locks

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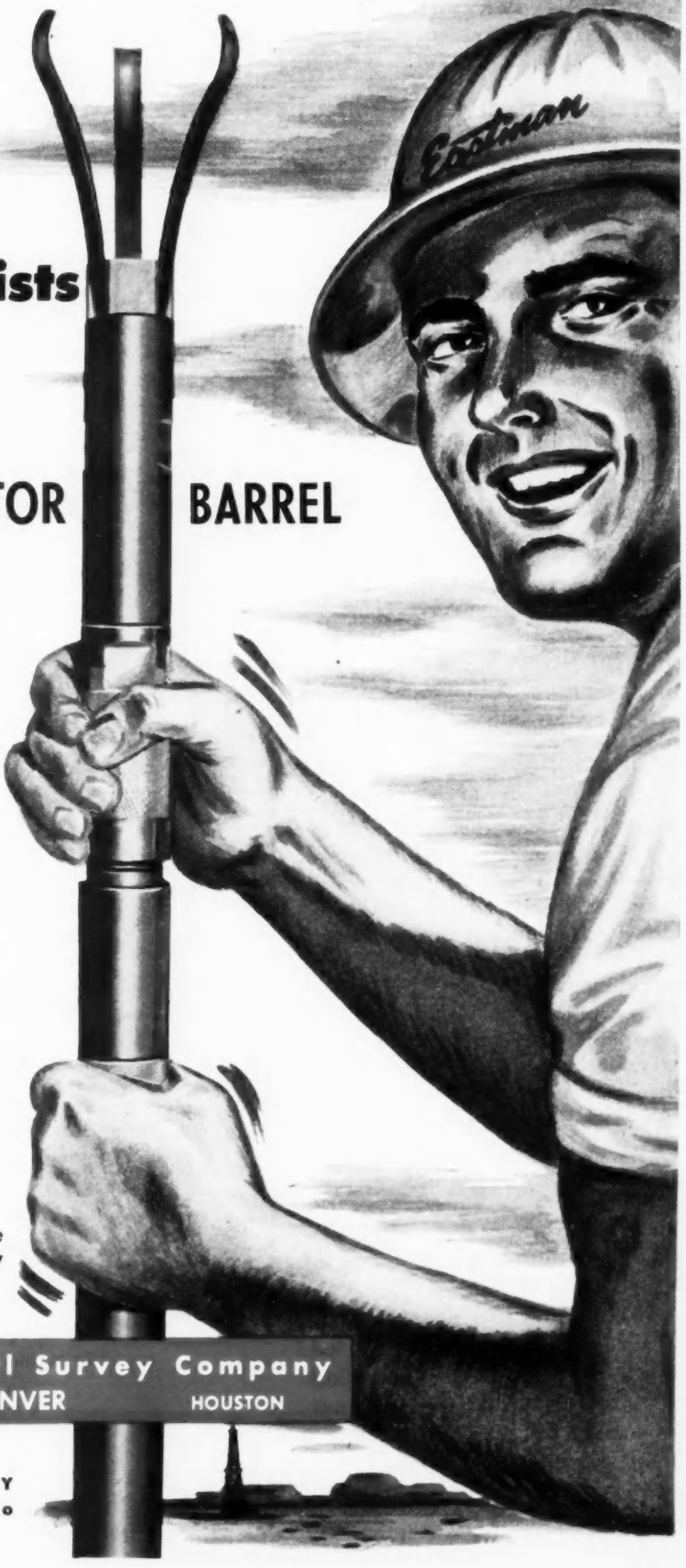

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to use economically a small conventional rig for slim hole drilling because of the need for investment in special tools to permit slim hole drilling.

7. Converting conventional rig. There are no serious mechanical problems incident to the employment of a properly equipped and staffed slim hole drilling rig but there are some serious obstacles in the path of a conventional rig entering in upon a slim hole drilling program.

Extrapolation of mechanical data to deeper 5⅝-inch drilling . . .

The circulation tests conducted at 3000 feet and 6000 feet provide reliable data which may be used to predict the operating conditions which will be encountered in deep slim hole drilling. Mud properties, number and bore of drill collars and other conditions will affect circulating pressures, but mud used during circulating tests should be quite typical of that which would be required for almost any deep drilling in a comparable area. Ten drill collars with 2¼-inch bore should provide a reasonable approximation of the collars necessary to accomplish that drilling. It is believed, therefore, that the data may be used with considerable confidence.

Little purpose would be served by extrapolating all data accumulated, only those data pertinent to a prediction of actual operating requirements are significant. For that reason, extrapolation of data is restricted to the volumes and pressures incident to the development of 175 feet per minute annular mud velocity. This is considered a minimum velocity requirement for design purposes. In hard, competent rock, a lesser velocity will suffice but unless adequate circulating equipment is incorporated into a rig design, it will not be available when needed.

One hundred sixty-seven gallons per minute will produce a theoretical annular velocity of 175 feet per minute. Velocities developed by other rates of circulation are shown in Table 4 and displayed graphically in Figure 3.

The pressures required to circulate 167 gallons per minute (175 feet per minute annular velocity) are displayed in Figure 4. Using the common assumption of a 15 percent loss in mechanical efficiency through the pump, the input horsepower to the pump pulley is also shown in Figure 4. The data are tabulated in Table 5.

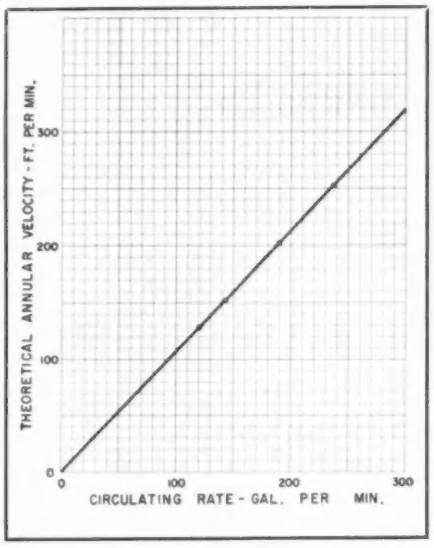

Fig. 3—Circulation rate vs. annular velocity 2⅞-inch OD drill pipe in 5⅝-inch hole.

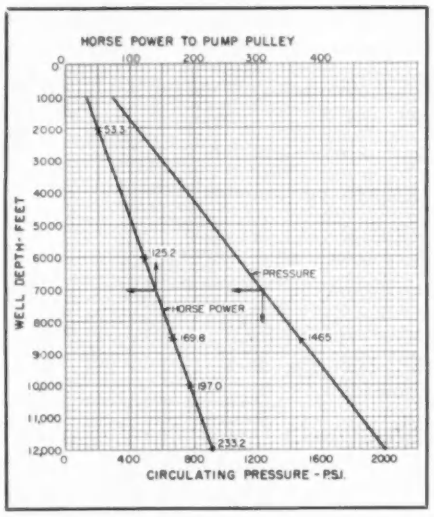

Fig. 4—Circulating pressure and horsepower to pump pulley to pump 167 gallons per minute developing 175 feet per minute annular velocity in 5⅝-inch hole with 2⅞-inch OD tubing.

At a depth of 5091 feet, with 12 feet of kelly in the hole, 186 feet of drill collars and 4893 feet of 6.5 pounds per foot tubing (7.4 pounds per foot with tool joints), it required 25 seconds to hoist a 61-foot stand of pipe on a trip after the kelly had been set back. The load being hoisted weighed:

4893 feet tubing at 7.4 pounds per foot	36,208 pounds
6 drill collars at 1440 pounds each	8,640 pounds
Total weight in air	44,848 pounds
Weight in 9.6 pounds per gallon mud (0.853)	38,255 pounds

Moving 38,255 pounds 61 feet in 25 seconds required $\frac{38,255 \times 61}{25 \times 550} =$ 169.7 horsepower delivered to the hook. Previous investigations had established the fact that on conventional rigs the horsepower that could be counted on at the hook was approximately 66 percent of the manufacturer's rating of the drawworks engine when hoisting off bottom, it is less when the consideration of speed reduces the applied engine horsepower. Sixty-six percent of the 260 hp diesel engine on Schultz 6 was 171.6 hp.

The conclusion may be reached that the principles of design developed for conventional rigs apply also to slim hole rigs and an over-all mechanical efficiency from manufacturer's engine rating to hook of 66 percent can be used with confidence. This is important in the development of a rig design for deep drilling. It is customary to power a rig to permit hoisting speeds of 100 feet per minute

TABLE 4

Theoretical Annular Velocity 2⅞-Inch OD Pipe in 5⅝-Inch Hole

Circulation Rate Gal. per Min.	Annular Velocity
124.0	130
133.6	140
143.1	150
152.7	160
162.2	170
167.0	175
171.7	180
181.3	190
190.8	200

TABLE 5

Pressure and Horsepower to Pump Pulley to Circulate 167 gpm Through 2⅞-Inch OD Tubing Developing 175 ft/min Annular Velocity in 5⅝-Inch Hole

DEPTH	Pressure	Input Horsepower
2,000 feet	460 psi	53.3 h.p.
6,000 feet	1080 psi	125.2 h.p.
8,500 feet	1465 psi	169.8 h.p.
10,000 feet	1700 psi	197.0 h.p.
12,000 feet	2012 psi	233.2 h.p.

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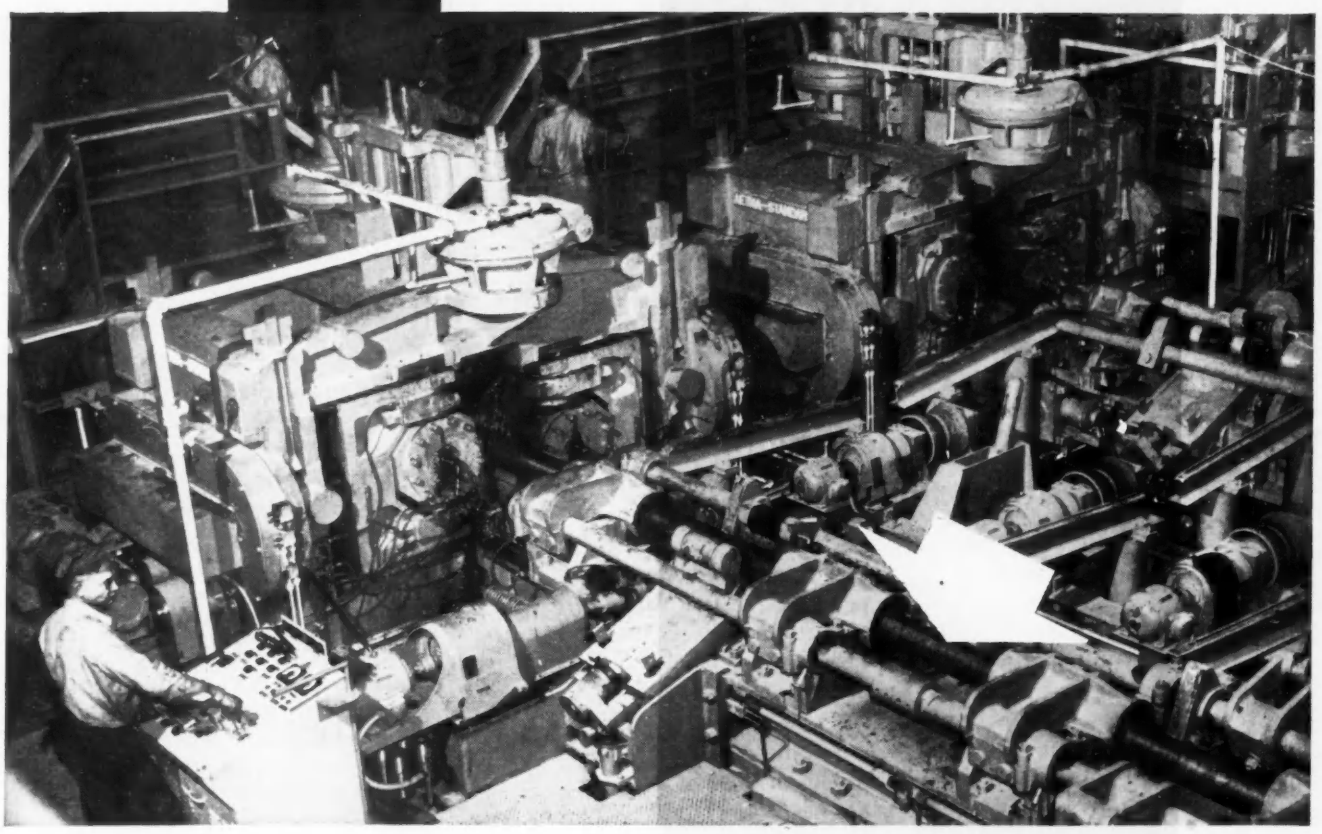

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off bottom and on this basis, the required horsepower delivered to the hook and the manufacturer's rating of engines to assure that power delivery are shown in Table 6 and displayed graphically in Figure 5.

TABLE 6

Hoisting Horsepower for 100 ft/min with 7.4 lb/ft 2⅞-Inch OD Tubing-Drill Pipe and 10 Drill Collars in 10.5 Pounds Per Gallon Mud

DEPTH	Delivered to Hook	Mfg. Eng. Rating
3,000 feet	87.4 h.p.	132.4 h.p.
6,000 feet	143.9 h.p.	218.0 h.p.
8,500 feet	190.9 h.p.	289.2 h.p.
10,000 feet	219.1 h.p.	332.0 h.p.
12,000 feet	256.7 h.p.	389.0 h.p.

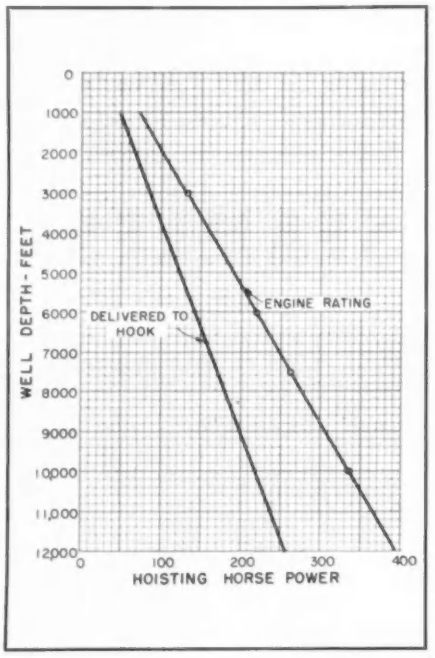

Fig. 5—Hoisting horsepower 2⅞-inch OD tubing drill pipe, ten 4¾-inch OD drill collars.

Estimation of 4¾-inch hole requirements and comparison with 5⅝-inch hole . . .

Fluid requirements to produce 175 feet per minute annular velocity between 2⅞-inch OD pipe and a 4¾-inch hole are 102 gallons per minute, a substantial reduction from the 167 gpm required for a 5⅝-inch hole. The pipe through which each of the volumes would be pumped is the same; hence, pressure and horsepower requirements are substantially less when a 4¾-inch hole is drilled. A comparison of pressures and required horsepower to the pump pulley is shown in Table 7 and graphically in Figure 6.

Pressures in a 4¾-inch hole are approximately half those required in a 5⅝-inch hole and the horsepower requirements to the pump pulley are slightly less than one third. Both are very potent considerations in favor of the smaller hole.

Hoisting loads will be quite similar for the two hole sizes, the only difference being in drill collar weight. A 4¾-inch OD by 2¼-inch ID, 30-foot long drill collar weighs 1400 pounds in air. A 4¼-inch OD by 2⅛-inch ID, 30-foot long drill collar weighs 1086 pounds in air. If ten collars were used in each hole size, the difference in weight would be 3140 pounds in air or 2635 pounds in 10.6 ppg mud. The hoisting horsepower requirements to the hook to permit a hoisting rate of 100 feet per minute and the engine rating necessary to deliver that hook requirement are shown in Table 8.

The similarity in required hoisting horsepower is the principal deterrent to the drilling of a 4¾-inch hole. It has been shown that circulating horsepower requirements for a 4¾-inch hole are less than one third those required for a 5⅝-inch hole but hoisting horsepowers are nearly equal being in excess of those required to circulate even the 5⅝-inch hole.

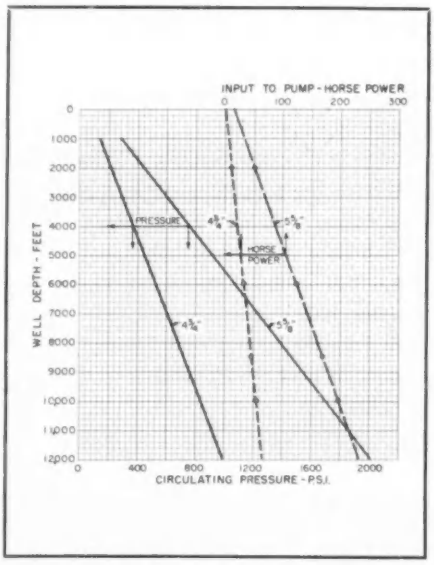

Fig. 6—Circulating pressure and input horsepower to pump; 2⅞-inch OD tubing, 175 feet per minute annular velocity in 4¾-inch and 5⅝-inch holes.

If the engine horsepower must be installed to satisfy hoisting demands, the advisability of using only approximately 25 percent of the available horsepower to circulate, is open to question. As long as it is there, it might as well be used to drill the 5⅝-inch hole and realize the advantages inherent in the larger size.

Pump pulley horsepower has been previously established (see Table 7) but no factor has been selected for discounting the manufacturer's continuous engine rating similar to that empirically established of 66 percent of engine rating to the hook for hoisting. For the purpose of this discussion, a loss of 25 percent from engine rating to pump pulley will be used. The loss may be greater in actual practice. On that basis, the rated installed engine horsepower required to circulate at a rate of 175 feet per minute annular velocity and hoist at 100 feet per minute tubing-drill pipe with ten drill

TABLE 7

Circulating Pressure and Pump Input Horsepower Requirements for 175 ft/min Annular Velocity Using 2⅞-Inch OD Tubing

	4¾ INCH HOLE		5⅝ INCH HOLE	
DEPTH	Pressure	Horsepower	Pressure	Horsepower
2,000 feet	225 psi	15.9	460 psi	53.3
6,000 feet	530 psi	37.5	1080 psi	125.2
8,500 feet	727 psi	51.5	1465 psi	169.8
10,000 feet	844 psi	59.7	1700 psi	197.0
12,000 feet	1000 psi	70.8	2012 psi	233.2

TABLE 8

Hoisting Horsepower for 100 ft/min Speed 2⅞-Inch OD Tubing 10 Drill Collars 10.5 Pounds Per Gallon Mud

	4¾ INCH HOLE		5⅝ INCH HOLE	
DEPTH	To Hook	Installed	To Hook	Installed
3,000 feet	78.4	118.8	87.4	132.4
6,000 feet	134.9	204.3	143.9	218.0
8,500 feet	181.9	275.6	190.9	289.2
10,000 feet	210.1	318.4	219.1	332.0
12,000 feet	247.7	375.4	256.7	389.0

collars is shown in Table 9 and displayed graphically in Figure 7.

If the assumption is made that 50 horsepower would be required for the rotary table for either hole size, then total rig requirements, less light plant, water pump, shale shaker, etc., is shown in Table 10.

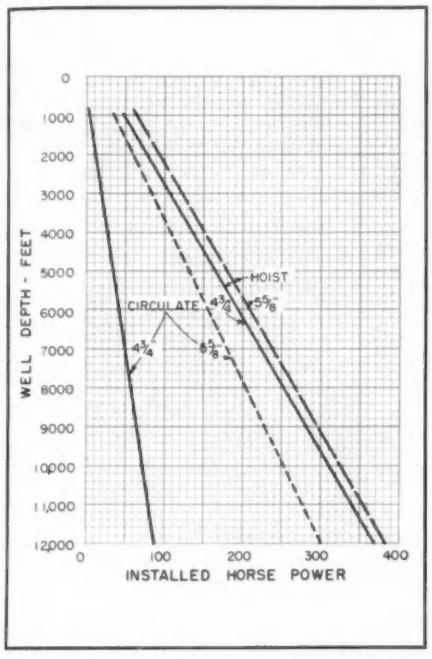

Fig. 7—Engine rating to hoist at 100 feet per minute and circulate at 175 feet per minute; 2⅞-inch OD tubing; ten drill collars.

These power installations would be required for individually-driven units. Requirements can be reduced by using the same power supply for more than one demand where the demands do not occur simultaneously.

TABLE 9

Horsepower Installation Required to Hoist 2⅞-Inch OD Tubing-Drill Pipe With 10 Drill Collars 100 ft/min and Circulate to Produce 175 ft/min Annular Velocity

	4¾ INCH HOLE		5⅝ INCH HOLE	
DEPTH	Circulate	Hoist	Circulate	Hoist
2,000 feet	21.2	....	71.1	....
3,000 feet	....	118.8	....	132.4
6,000 feet	50.0	204.3	166.9	218.0
8,500 feet	68.7	275.6	226.4	289.2
10,000 feet	79.6	318.4	262.7	332.0
12,000 feet	94.4	375.4	310.9	389.0

TABLE 10

Total Installed Horsepower Requirements

	4¾ INCH HOLE		5⅝ INCH HOLE	
	8,500 Feet	12,000 Feet	8,500 Feet	12,000 Feet
Rotary Table	50 h.p.	50 h.p.	50 h.p.	50 h.p.
For Pump	68.7	94.4	226.4	310.9
For Hoist	275.6	375.4	289.2	389.0
Total	394.3	519.8	565.6	749.9

Rig design for 4¾-inch and 5⅝-inch hole to 8500 and 12,000 feet . . .

Conventional internal combustion engine powered rigs are assembled in one of two ways: If all of the engines are installed behind the drawworks, it would be called a compound rig; or if drawworks and pump are individually powered, it would be known as a split rig.

The split rig is easier to rig up because the pump and its engine can be placed at any convenient location. Most so-called slim hole drilling rigs are of this type.

A split rig is convenient and quite satisfactory for normal hole size drilling even though almost duplicate power installations are required, one on the pump and one behind the drawworks. However, when 2⅞-inch OD tubing is used for drill pipe, the drawworks engine is too powerful for safe application to the rotary table.

The ability of tubing to transmit power to the bit is approximately one third that of 4½-inch OD Grade D drill pipe.

An individual rotary table drive is very essential for a slim hole rig to avoid the application of excess power to the table.

A compound rig has less power available for the rotary table because the pump is drawing its power also from the common pool while drilling is in progress but there is still insufficient evidence of down hole trouble developing during drilling.

In one instance when 2⅞-inch OD N-80 tubing was used for drill pipe, a new bit stuck without the driller's knowledge and he rotated for ten minutes at 70 rpm before he realized that the bit had not turned. Each length of that tubing had three complete turns remaining in it when it was pulled from the hole. Had 4½-inch drill pipe been subjected to the same conditions, positive indication of the trouble would have become evident through the action of the engines.

The split rig used on the Schultz 6 had a twin diesel behind the drawworks and another, individually driving the pump. The one behind the drawworks drove through a torque converter. It became the practice to cut out one bank of the twin engine behind the drawworks while drilling in order to reduce the available horsepower to the rotary table. The bank in operation was throttled down to further reduce the available horsepower to the rotary table. As a result of this practice, the operating engine ran for extended periods of time at slower than its best operating speed at very low loads and it therefore ran cold and required considerable mechanical attention. In addition, when needed, the second bank would be cut in and would be subjected to heavy loading before it had an opportunity to warm up. The diesel engine driving the pump would, of course, idle whenever circulation was stopped.

A slim hole rig is an exploratory tool; and diesel power is considered proper for a slim hole drilling rig.

Diesel engines perform best if they are run at constant speed and under uniform loading. Probably the hardest service to which diesel engines can be subjected is idling over extended periods of time. Torque converters on drawworks engines do permit load application while the engine is running at proper speed. A straight diesel engine drive to the drawworks requires that the speed of the engine be varied through its entire range while hoisting drill pipe. In addition, the load is applied on that engine while it is turning at a very low rate and before it has come up to speed so that it can deliver its horsepower.

A diesel-electric installation could compete economically with a straight mechanical drive split rig because one motor would drive both the drawworks and the pump. Electric power would provide an ideal rotary table drive and would insure the degree of sensitivity so necessary when tubing is used as drill pipe.

Portability is important in the design of a slim hole rig. The weight of the individual units should be held to a minimum to permit moving over difficult terrain and over poorly constructed bridges. A diesel-electric rig would satisfy these requirements because the individual units can be skid mounted and quickly dismantled and reassembled on the next location. No

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heavy engine support to elevate engines to the level of the derrick floor would be required and the individual pieces of the rig could probably be transported over bridges limited to seven-ton maximum load. Such load restrictions are not at all uncommon on bridges on principal highways in the Rocky Mountains.

Truck or trailer mounting is questionable for a slim hole rig again because of the enormous concentration of weight on one vehicle. This is not too objectionable for development drilling where a wheel-mounted rig would be moved around over lease roads and only rarely would it be moved over the highway, but in wildcat drilling some highway operation will be required and often the final road to the location will be one that a 60,000-pound or 70,000-pound wheel-mounted unit could never negotiate without assistance.

A skid-mounted rig consisting of as many as necessary small units will be more desirable. A trailer rig usually requires a big truck to haul and all that is mounted on the trailer is a small drawworks and engine. Almost any truck could haul the engine and drawworks if they are skid mounted. Regardless of the extent to which drilling equipment is wheel-mounted, the need for hauling drill pipe, fuel tanks, mud tanks, dog houses, etc., can never be eliminated.

Pumps limit deep slim holes. A pump suitable for deep slim hole drilling may be difficult to obtain. A 5-inch by 12-inch pump is appropriate; at 60 rpm it would have a 207 gallons per minute capacity, the maximum needed. It would produce the required 167 gpm at 49 rpm which is a more conservative pump speed; rod and piston wear is reduced at the lower speed. However, most 12-inch pumps have an inadequate gear end for the pressures involved. The pressures and gear end loading are shown in Table 11.

The gear end rating of one common 12-inch pump is 19,800 pounds; another is 19,400 pounds; and another, 17,000 pounds; all would be overloaded below 5500 feet. Some experimentation with plunger pumps in mud service has been completed and results appear promising at present. They have been used by service companies for hydraulic fracturing with sand laden fluid but a typical unit makes 20 jobs a month and is under pressure 30 minutes each job.

TABLE 11
Pump Requirements for 5⅝-Inch Hole

DEPTH	Pressure	Plunger Load 5 Inch Pistons
8,500 feet	1,465 psi	28,000 lb.
10,000 feet	1,700 psi	33,000 lb.
12,000 feet	2,012 psi	39,000 lb.

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Comparison of estimated results of drilling 4¾-inch and 5⅝-inch holes . . .

It appears certain that with 4¾ or 5⅝-inch hole size, drilling time will be equal to or longer than conventional hole size drilling time. This is primarily the result of less efficient rock bits in the smaller sizes.

Four and three-quarter-inch rock bits should be less efficient than 5⅝-inch because of less adequate bearings. It is mechanically possible to washover and overshot fish any part of the drilling string in a 5⅝-inch hole and 4½-inch OD casing could be run in most instances. Spears or taps can only be used to fish in a 4¾-inch hole and reaming would be required for almost any casing string.

Since slim hole drilling can be expected to be slower, economic benefits can be obtained only by reducing the unit cost of operation. The 4¾-inch hole size is more attractive in this respect because the pumping equipment may be smaller, hence cheaper to purchase and move. The hoisting equipment is practically identical for either hole size.

The use of power slips and tongs makes possible a reduction in crews to four men usually, and to three men in some instances. Fuel costs are reduced commensurate with the reduction in installed horsepower; an approximate figure would be from $75 per day to $45 per day for diesel fuel. The most important saving would be in moving costs. Unless these potential savings can actually be realized the longer drilling time of the slim hole cannot be absorbed.

Conclusions . . .

The slim hole drilling picture now is considerably clearer; the longer drilling time must be offset by reduced operating costs to make the operation profitable. There are no serious mechanical problems peculiar to the reduced hole size with the possible exception of fishing in a 4¾-inch hole. The 5⅝-inch hole is gen-

Continued on Page 156

Probably a more proven approach lies through compounding two piston pumps where the load is distributed between two small pumps.

Other investigators have established that seven percent of the downtime on a single pump rig could be avoided if a standby pump were available. Two small pumps could be operated in parallel when needed, singly when needed, or in series beyond 5000 feet where pressures begin to exceed the load carrying capacity of one pump. Power pumps have been compounded successfully, and while the practice is not common, it is being employed today in big rig operations.

The full economic benefits of slim hole drilling will not be realized unless rigs designed for specific exploratory drilling programs are employed. There is equal need for rig specialization in conventional drilling. Contractors are not normally informed on operators' exploratory drilling programs; hence, they are reluctant to invest in equipment which may have limited demand. One solution to the problem seems to be ownership of slim hole rig or rigs by operators, designed for their specific exploratory program.

Ohio's Rig Is Still Cutting Costs

By popular demand, here's a progress report on the rig that started everyone to thinking about slim hole.

WORLD OIL published an article on The Ohio Oil Company's slim hole rig in June, 1953. The article proved tremendously popular. Reprint supplies have long since been exhausted.

Since the article was published, some questions have been raised.

- **Is Ohio's rig as good as reported?**
- **How would conventional "big rigs" exercising good drilling practices perform in the same area?**
- **How near capacity are mud pumps run?**
- **What problems are apparent after several years experience?**

WORLD OIL asked H. D. Hoopman, drilling foreman for The Ohio Oil Company and co-author of the original article, to answer these and other questions.

Q *Could you give a short summary of your slim hole operations to date?*

A In July, 1952, The Ohio Oil Company moved its Rig 2 to western Nebraska and modified the equipment for slim hole (4¾ inch) drilling. (See June, 1953, WORLD OIL, Page 107.) Ten wildcat wells were drilled during the following 11 months of continuous operation. This completed our schedule of work at that time, and the rig was stacked for six months. In December, 1953, the rig was moved to northeastern Colorado to continue the slim hole wildcat program and is now drilling at 3000 feet on the second well in that area. Of the 11 wells drilled to date, three were Dakota tests and eight were Pennsylvanian tests. One well was completed for production as described in the June, 1953, issue of WORLD OIL and in an API paper presented May 8, 1953.

The drilling program has been very similar on all wells. In all cases 9-inch surface hole was drilled, 7-inch outside diameter casing set, and 4¾-inch hole drilled for footage. All coring was done with the hydraulic wire line core barrel using 4¼-inch OD x 1¾-inch diamond core heads. The core hole was reamed to 4¾ inches. A 3¾-inch tool has been used on all formation tests to date. Electric or radioactive logs were run on all wells. On two wells we were unable to get the micro log sond to total depth.

Q *Has the economics of slim hole been indicated by Ohio's experience? Explain.*

A Dry hole costs have been substantially reduced by slim hole drilling in most cases. Our first well cost 18 percent more than a conventional wildcat well drilled in the same area. Slim hole costs included a 428-mile move and the re-rigging of the equipment. The second well which was completed for production cost virtually the same as conventional drilling and completion. An estimated savings of 25 percent to 55 percent of the over-all costs of a dry hole was experienced on the next eight wells. The eleventh well cost about 50 percent more than a comparable well drilled with conventional tools. This cost included a total accumulation of 55 days fishing time.

Q *What contributed most to the success of Ohio's venture?*

A The very liberal attitude of the company management towards experimentation with radically different drilling procedures aided greatly in the success of the slim hole operation. Without this willingness to gamble on untried equipment and procedures, it would have been impossible to develop our drilling technique in such a short time. By making select crews available on the rig it was possible to avoid many difficulties which might have been attributed to inexperience.

Q *What is your opinion of the rig after two years' experience? What about management's opinion?*

A The rig is a single-drum servicing hoist recommended for well servicing to 9000 feet. The rig is powered by a 180-horsepower diesel. The mast is 94-foot converted and trailer-mounted model rated at 150,000 pounds. The rig now in use is the one described in the June, 1953, issue of WORLD OIL and only minor changes have been made since that time.

We feel that the rig was not designed to take full advantage of slim hole drilling technique; however, it is satisfactory for experimental work. We feel that additional experience will be necessary before a choice of equipment can be made that will best suit our purpose.

The management is impressed with the possibilities of reduced wildcat costs; however, they are willing to use present equipment to accumulate more drilling experience.

Q *What fluid volumes and pressures are demanded for various size holes?*

A Our experience has been limited to 4¾ inch hole size. In two wells this was reamed to 6¼ inches. In the 4¾ inch hole we found it desirable to have available a maximum circulation rate of 200 gpm at 800 pounds pressure. In the 6¼ inch hole we have run circulation rates of 225 gpm with pressures

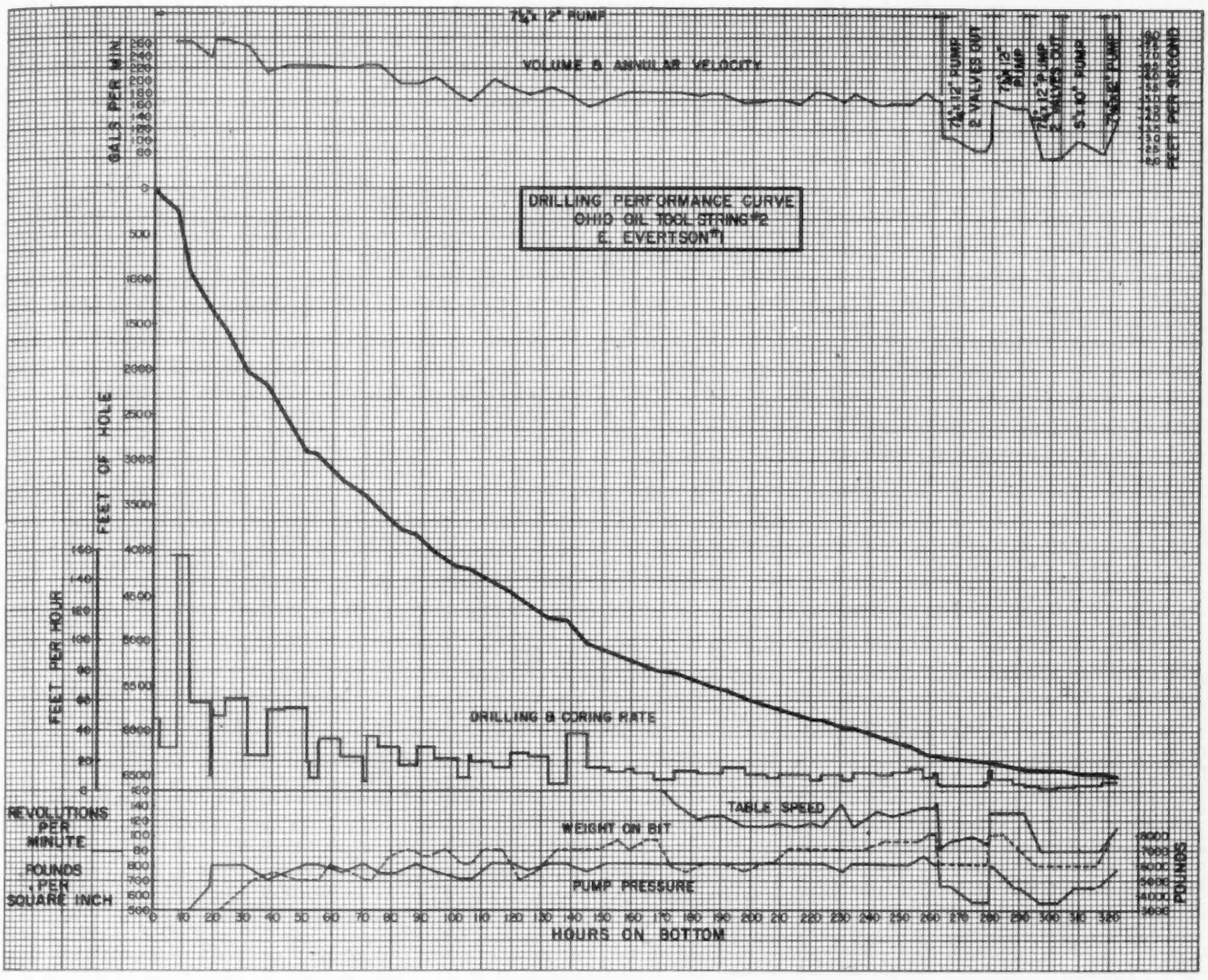


Fig. 1—Penetration curve and performance data on a 6500-foot well drilled with The Ohio Oil Company's slim hole rig.

around 900 pounds. These pressures and volumes are the maximum we have used.

Q *Do you have a comparison of a slim hole well with an offset drilled with the conventional method?*

A It is rather difficult to pick two wells of same depth for comparison because of different amounts of surface pipe, coring, testing, and drilling trouble. Table 1 compares the slim hole wells and what we consider representative comparative wells.

Q *What pumps are used and how near capacity are they run?*

A A 5 x 10-inch, 50-hp pump, driven by a 136-hp gas-gasoline engine through a twin disc torque converter, chain driven, has been used satisfactorily to drill eight wells. This pump has five-inch liners and a ten-inch stroke and will turn 70 strokes at engine governor speed. The pump is rated by the manufacturer at 68 input hp with a maximum discharge pressure of 440 pounds, using five-inch liners. We have been operating the pump up to 150 hp input and 800

TABLE 1 Comparative Data—Slim Hole vs. Conventional Wildcat

WELL	Rig Type	TD	Bits	DST	Footage Cored	Days to Move	Days to Drill	Miles Moved	Completion
Slim Hole No. 1—Niebuhr No. 1	Ohio Slim Hole Rig	4787	11—4¾	3	107	11	20	428	Abandon
Comparison No. A—Lanzen No. 1	320 H.P. Rig at 5500′	4807	4—8⅝	2	152	1	14	6	Abandon
Slim Hole No. 2—J. F. Beyer No. 1	Ohio Slim Hole Rig	5015	13—4¾ 3—6¼	4	128	2	27	12	Producing
Comparison No. B—Runge No. 1	450 H.P. Rig at 7000′	4990	6—8⅝	6	112	3	16	6	Producing
Comparison No. C—Kugler No. 1	320 H.P. Rig at 5500′	4627	4—8⅝	6	127	1	18	9	Producing
Slim Hole No. 3—Evertson No. 1	Ohio Slim Hole Rig	6514	19—4¾	1	109	2	23	49	Abandon
Comparison No.D—Torgenson No.1 (Contracted)	600 H.P. at 7500′	6547	12—8¾	?	49	?	19	...	Abandon
Slim Hole No. 4—Maloley No. 1	Ohio Slim Hole Rig	3892	12—4¾	..	1318	5	36	245	Abandon
Slim Hole No. 5—Stear No. 1	Ohio Slim Hole Rig	3742	13—4¾	2	862	2	31	12	Abandon
Slim Hole No. 6—Pettett No. 1	Ohio Slim Hole Rig	3898	16—4¾	..	1051	4	36	14	Abandon
Slim Hole No. 7—Taylor No. 1	Ohio Slim Hole Rig	4043	—4¾	2	1246	2	34	18	Abandon
Slim Hole No. 8—Doyle No. 1	Ohio Slim Hole Rig	4117	25—4¾	3	248	5	26	129	Abandon
Comparison No. E—Machlan No. 1	320 H.P. Rig at 5500′	3970	16—8¾	1	377	6	22	191	Abandon
Slim Hole No. 9—Wiggins No. 1	Ohio Slim Hole Rig	4201	26—4¾	..	152	5	17	111	Abandon
Slim Hole No. 10—Dunse No. 1	Ohio Slim Hole Rig	4029	14—4¾	..	497	7	23	154	Abandon
Slim Hole No. 11—Gall No. 1	Ohio Slim Hole Rig	5848	33—4¾ 27—6¼	5	53	12	101	224	Abandon
Comparison No. F—Brophy No. 1	450 H.P. Rig at 7000′	6380	38—9″	5	723	8	59	110	Abandon

Rig type—Comparison Well—based on horsepower and depth rating with 4½-inch drill pipe.

pounds pressure with the five-inch liners. In other words, we are operating well over 200 percent of the manufacturer's recommended rating. The pump has performed satisfactorily in every respect, and maintenance costs have been very low.

A 5½ x 12-inch, 150 hp duplex pump, driven by a 235-hp natural gas-butane engine through a twin disc friction clutch and conventional belt drive, has been used to provide high pump capacities. This pump is dressed with 5½-inch x 12-inch liners and is being used to check the effect of greater circulating volumes on hole conditions and penetration rates. It has been used intermittently on four wells.

Q *Where can pumps be obtained that will give the pressures required for slim hole techniques?*

A In my opinion, a 5-inch x 10-inch pump would be sufficient for most slim hole operations if sufficient horsepower is provided to hold the pump to speed at the operating pressures encountered; that is, 60 to 65 strokes at 800 pounds. Most pumps available which have a maximum liner size of 5-inch x 10-inch are not designed for that high pressure in the gear box. One solution to this would be to use a larger pump with sufficient gear end capacity and install smaller liners.

Q *What special equipment is needed to convert conventional rig? What future designs will aid?*

A Most of the equipment we are using is of standard design. In many cases it is applied differently than the manufacturer recommended. In general, equipment presently available is a good deal heavier than is necessary for this type work. Some changes in design could be effected which would materially reduce moving costs.

Q *Will drill pipe, pumps, swivels and other equipment have to be modified for effective use of modern day slim hole technique?*

A The first string of pipe, described in the earlier paper, was used to drill 49,393 feet of hole before we experienced our first twistoff. This we consider satisfactory performance. Of course, we would like improvement and are considering modification of the drilling string.

There seems to be a great variety of auxiliary equipment available. By careful choice it seems that most any equipment requirement can be met without additional design work.

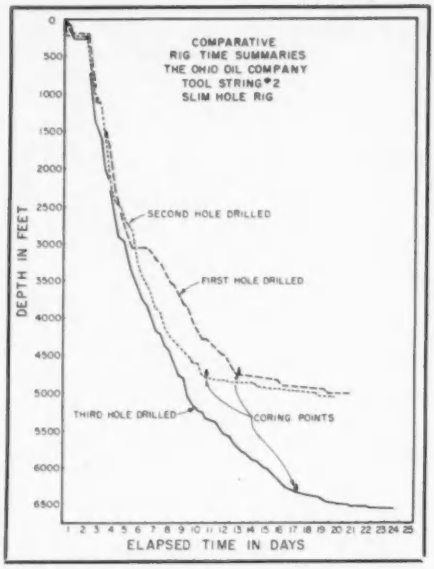


Fig. 2—Drilling time chart compares three wells drilled with slim hole rig.

Table 2. Time charge breakdown on 6500-foot well indicated in Figure 1.

CHARGE	DAYS
Moving and rigging up	2
Drilling	17
Day work	6
Equipment maint. and repair	⅔
	25⅔

CHARGES BY THE HOUR MOVING	HOURS
Tearing down, moving and rigging up	18
Drilling rat and mouse hole	4
DRILLING	
On bottom	280½
Connections	9¾
Trip time	74¾
Working tight or stuck pipe, drilling bridges, conditioning hole	2¼
Cleaning balled, plugged bits	2¼
Running surface casing and W.O.C.	23½
Laying down drill pipe	9¾
Circulating up sample	½
Fishing for cone in the hole	4
DAY WORK	
Servicing rig	1
Coring	42½
Retrieving cores	23¼
Trips	25¼
D.S.T. (trips and conditioning hole)	10
Circulation to condition hole	7¾
Ream rat hole	3½
Logging (trips and conditioning hole)	14¼
Waiting on orders	2¼
EQUIPMENT	
Maintenance and repair	15½
Routine rig service	9½

Q *What has been Ohio's experience with hole deviation? How is this controlled?*

A We have surveyed four slim holes. The maximum deviation found in any one of the four holes was 3¼ degrees; therefore, we feel that hole deviation was not a problem in the area in which we were operating.

Q *What loads are carried?*

A In the 4¾-inch hole we normally run 5000 to 6000 pounds. In extreme cases we have run as high as 9000-pound weight on the bit. Rotary speeds varied from 100 to 170 rpm.

Q *What have been the bit limitations?*

A Due to the small physical dimensions of the 4¾-inch bits, bearings of a rugged design are difficult to make. We have used bits manufactured by several different companies and find quite a variation in bearing life. Some experimental designs are presently being worked out which should extend the life of the bits. Bit tooth patterns are also limited because of the size of the bit, and as yet no bit is available that will drill the medium soft formations as rapidly as could be expected from the larger size bits.

We have used drag bits satisfactorily in the softer formations. Two-cone and three-cone and four-cone rock bits are available in the 4¾-inch size with a variety of cone patterns. Diamond bits show promise in the small size; however, we have not been in an area where diamond drilling is economically practical. Our drilling program has been limited to the 4¾-inch size.

Q *Has Ohio completed any slim hole wells? If so, what was the casing program?*

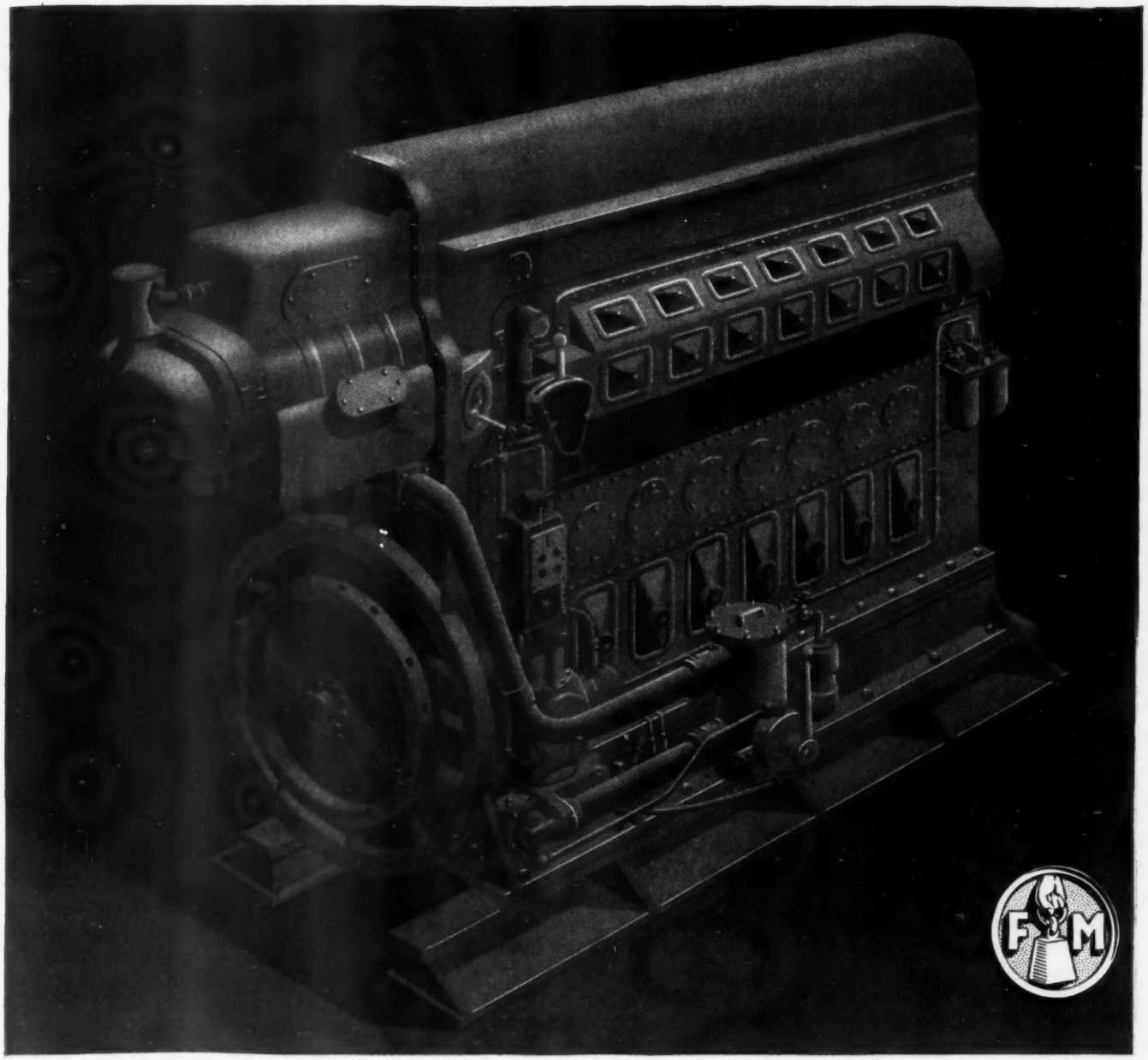
A In J. F. Beyer 1 production was found at 4781 feet while drilling with a 4¾-inch bit. The decision to complete the well was made. Instead of moving in a big rig to drill another hole it was decided to use the small rig and to ream the 4¾-inch bore to 6¼-inches and run a string of 4½-inch OD, 9.5-pound J-55 casing. It took 2⅔ days to perform this operation using three 6¼-inch rock bits. After allowing 36 hours for WOC time the plugs were drilled with a 3⅞-inch bit. Two and three-eighth-inch OD, UE tubing was run and the well was completed for 85 barrels of oil per day.

Q *What testing services are available for this technique?*

A Drill stem test tools are available for operating in holes down to 2¾-inch. We have used a rathole testing tool exclusively, and it has been satisfactory in every respect.

Q *What fishing techniques are used?*

A The pipe was stuck several times in drilling the first ten wells. It was



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Continued from Page 149

our practice to spot crude oil and work the stuck pipe. In every case the pipe came free from two to thirty-six hours after the oil was spotted. Our first fishing job occurred on the eleventh well and was the result of a twistoff at 4400 feet. We attempted to recover the fish using a releasing spear and found that the fish was stuck. We spotted oil and while attempting to free the fish, the fishing string became stuck. It was necessary to ream the hole to 6¼-inch and wash over using 4½-inch pipe in order to clean up the hole. A second twistoff occurred within two days; again the fishing string was stuck and it was necessary to wash over. This experience did not add materially to our knowledge of fishing in a 4¾-inch hole in that we were operating in a 6¼-inch hole for 50 of the 54 days on this job. We are attempting to work out an overshot which will be suitable for use in the 4¾-inch hole.

Q *What size pipe can be washed over?*

A As yet we do not have a suitable string of washover pipe for use in the 4¾-inch hole. Some consideration is being given a string of special flush-joint pipe which can be used. However, no satisfactory answer has been worked out as yet.

Q *What constitutes a good slim hole rig? How does it differ from conventional?*

A Since slim hole drilling will be used only on wildcat locations often in widely separated locations, portability is one of the major considerations. This differs appreciably from the conventional rig in that most of the moves will be made over public highways and must meet existing laws. A rig which might be considered portable in a field or on a private road may not be a permitted load over the highway. The design should look toward easy disassembly to legal loads.

If tubing is to be used as a drilling string, the use of air slips and air tongs is a great advantage which can be gained at a low cost. We consider it a must in controlling make-up and breakout torques on lightweight pipe.

Q *What part did the diamond wire line core barrel play?*

A At the time we started the slim hole drilling, no core barrel was available that would operate economically in a small diameter hole. Costs of coring done with the hydraulic barrel in the slim hole have been compared with the costs of coring by conventional wire line or by conventional diamond barrel. We have found that the hydraulic barrel costs us 60 percent less than conventional diamond 6⅛-inch and 35 percent less than conventional wire line coring. In wells where a large section is to be cored this becomes a major cost item. The hydraulic wire line barrel has recently been adapted to conventional hole sizes which has reduced this cost advantage.

Q *Can gas lift be installed in slim holes?*

A We have had no occasion to consider a gas lift; however, I see no reason why it could not be applied.

Q *What application will permanent type well completions have?*

A Some consideration has been given to completing wells by using 4-inch OD extreme line casing and 2⅜-inch tubing. This would be a marginal completion and could hardly be considered for development wells. A gas well might be satisfactorily completed for test purposes and for low volume output by running either 3½ or 4-inch extreme line casing with a small diameter tubing string.

Q *Is the slim hole technique limited? If so, where?*

A Some areas undoubtedly will be more suitable for slim hole drilling. As yet we have experience only in the Julesburg Basin and further drilling will be required to determine which areas can be drilled by this technique. We feel that slim hole drilling is limited entirely to exploratory drilling.

Q *Is slim hole limited to present day equipment?*

A Undoubtedly changes in equipment will be made which will improve slim hole technique.

Q *What application will air as drilling media have for slim hole technique?*

A The slim hole technique should be very adaptable to air drilling methods in areas where that sort of drilling can be used successfully. The reduction in bottom hole area should appreciably reduce the amount of air required.

Q *What are the depth limitations?*

A I feel that our rig is limited to approximately 10,000 feet; however, Pegasus has drilled below that depth in Cole Creek, Wyoming, deepening job.

job.—**The End**

erally preferrable because so much of the auxiliary equipment such as core barrels, logging tools, drill stem testing and perforating devices are readily available without alteration.

The 5⅝-inch bits are longer lived and the tooth design selection is wider. The increased fluid requirements in the 5⅝-inch hole require greater pressures to circulate but the hoisting power requirements are practically identical. The sum of the horsepower requirements to the pump and to the rotary table are practically equal to the hoisting horsepower demands for a 5⅝-inch hole and since that horsepower must be available for hoisting in either size hole, it appears advisable to use it all continuously and drill the 5⅝-inch hole.

Equipment, particularly pumps, for drilling a 5⅝-inch hole deeper than 5500 feet is not readily available; additional engineering and design work will be required. An individual rotary table drive, while desirable but not too important on conventional rigs, is almost mandatory when 2⅞-inch OD tubing is used for drill pipe. The power into the table must be controllable at all times. Skid-mounted units have some advantages over wheeled units in that the weight of individual truck loads can be reduced. There is considerable doubt that wheel-mounted units weighing from 60,000 to 80,000 pounds could be moved over some of the roads a slim hole rig would be expected to negotiate.

The economic desirability of slim hole drilling is not yet very well established; there is no other advantage.

It may be impossible to ever realize fully the potential savings without a slim hole rig designed for a specific exploratory drilling program; the use of shallow, conventional hole size rigs for deeper slim hole drilling will not develop cost experience which may be directly utilized. The desirability of assembling a slim hole rig for any operator depends entirely on the drilling program for which it would be intended and no general statement would be valid. Under favorable conditions, significant savings could be made but they would not be high enough to insure that if conditions were something less than ideal, a saving would still be available.

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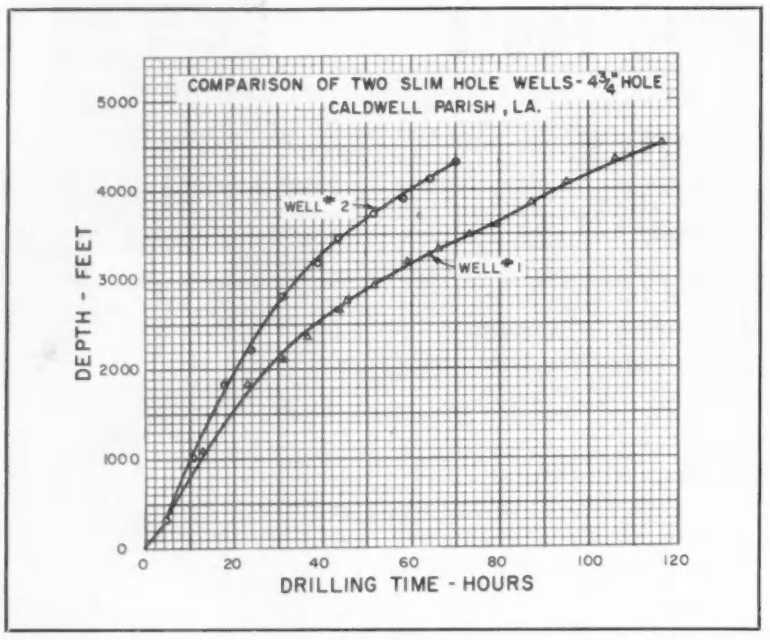

FIGURE 1

What Two Test Wells In Louisiana Found

Among other things they proved that slim holes can be tested, logged, and sidewall cored.

By JAMES W. ARNOLD, Woolf and Magee Drilling Company, Tyler, Texas

Two TEST slim hole wells were drilled in Caldwell Parish, Louisiana, by Woolf and Magee drilling contractors of Tyler, Texas, for the Nebo Oil Company, Inc., of Dallas. Tests were made to explore possibilities of slim hole method of drilling as an exploration tool to obtain stratigraphic information and to evaluate possible petroleum production in the Wilcox formation.

The formations tested were heterogeneous masses of interbedded and interfingering sands, grey-black shales, and lignites. The sands for the most part are fine to medium grained with the average porosity for the productive sands 25 to 30 percent and the average permeability from 40 to 500 millidarcys. Because of these formation characteristics, subsurface data interpretation was the most reliable method of Wilcox prospecting.

The object was two-fold:

- To determine if a 4¾-inch hole —slim hole—could be adequately surveyed, drill stem tested, side wall cored, and all of the necessary geological information obtained and
- To determine what drilling problems and hazards would be involved in drilling a 4¾-inch hole.

With these objectives in mind plans were made embracing the following items:

- Drill to total depth—through the Wilcox formation.
- Have a mud logging trailer to keep a running log of the well.
- Run electric log to total depth.
- After comparing electric log with mud log, side wall core points of interest with mechanically operated side wall coring tool run on the bottom of the drill pipe.
- Drill stem test favorable zones after checking and evaluating cores and logs.

Hole Size and Bits. The slim hole was to be a 4¾-inch hole. Some factors influencing use of 4¾-inch bits are their availability and choice, size and type of drill pipe used, and size and design of test equipment to be run in the hole. Following are the bit records of each well.

Well 1—4494 TD

4—Tricone rock bits (for medium rock formations) with jet subs jetted with three ¼-inch jets.

1—Tricone rock bit (for medium rock formations) with conventional watercourses.

2—Tricone rock bits (for hard formations) with conventional watercourses.

1—Tricone rock bit (medium hard to soft rock) with jet subs jetted with three ¼-inch jets.

Well 2—4286 TD

4—Tricone rock bits (for medium rock formations) with jet sub jetted with three ¼-inch jets.

The difficulties experienced on the first well with jet tubes were partially solved by increasing the recess of tubes into the sub, however, this did not eliminate the trouble entirely.

Drill Pipe and Drill Collars. A string of 2⅞-inch outside diameter 10.40 pound drill pipe with 4⅛-inch OD external upset tool joints was rented for the tests. Only one 4⅛ inch OD x 2⅛ ID x 30-foot drill collar was used. It was thought that by using 2⅞-inch drill pipe with its thicker wall section and greater all-around strength, any hydraulic saving caused by using 2⅞-inch OD tubing would be nullified. More drill collars would be necessary with tubing to keep the string in tension at all times.

While it might be advisable to use short strings of drill collars with the 2⅞-inch drill pipe no trouble was encountered and there was no sign of excessive wear on the tool joints nor was there any crooked pipe problem. Bit weight requirements will probably be a deciding factor in the number of drill collars to be used.

Rig. A 425-horsepower rig with a conventional derrick was used on the two wells. Although rig and equipment were larger than the job required it was the smallest rig available. The rig would be of sufficient size to meet any test requirements and from the results a smaller rig

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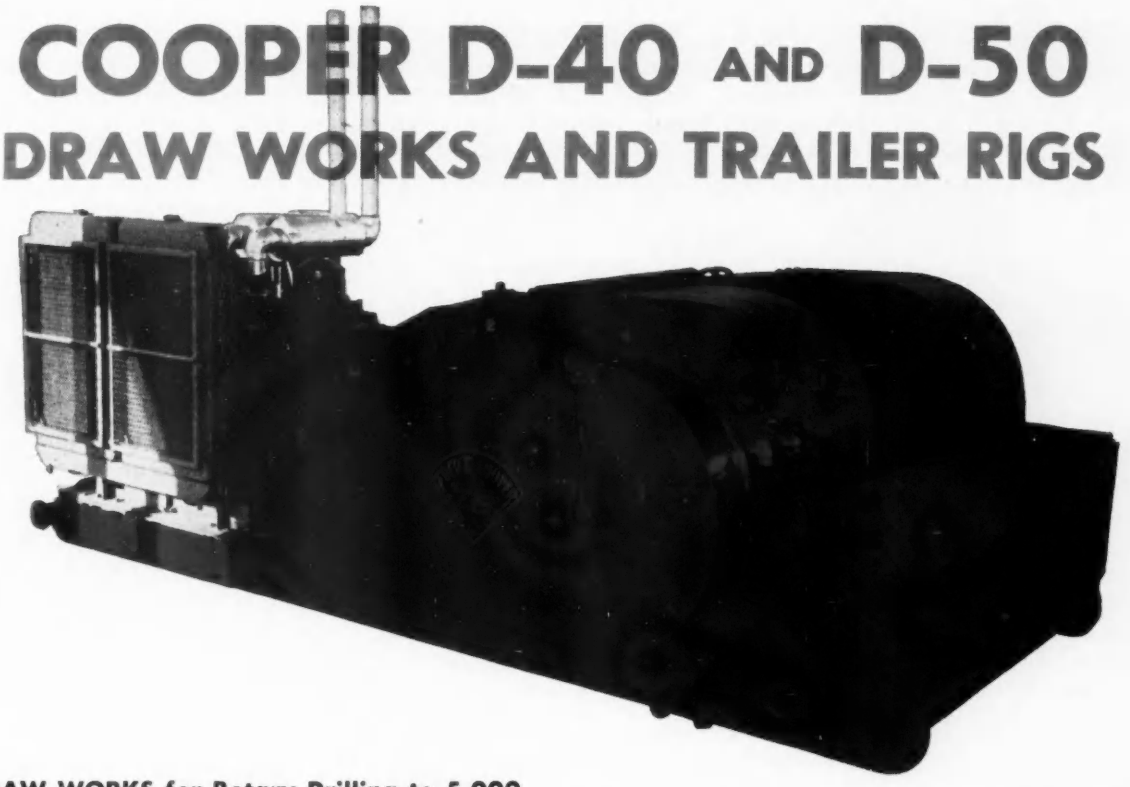

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could be assembled to meet the desired specifications. (See Table 1 for mud program.)

Well 1. The first well was spudded Sept. 13, 1953 and 333 feet of surface hole was drilled. 8⅝-inch OD casing was set at 326 feet. After 900 feet was made under surface casing a substantial increase in pump pressure was experienced. Upon pulling pipe out of hole, the jet tubes of a jet rock bit sub were found worn out from the rubbing action on the walls of the hole. Similar experience was encountered in the two jet bits run.

Two conventional rock bits were then run in succession and obtained only fair rates of penetration.

A rock bit with jet sub was run and an increase in penetration in order of 20-30 percent was noted. Another conventional bit was then run with the same reduction in penetration noted.

After completing the well, an electric log was run without encountering any trouble.

The drilling data are tabulated in Table 2.

TABLE 1

	Well No. 1 4494' TD	Well No. 2 4286' TD
Spud Mud	36 sks gel	20 sks gel
Clay	12 sks	
Tannic Acid	150 lbs.	50 lbs.
Caustic	100 lbs.	25 lbs.
Viscosity	30—40 sec. 8.3—9.7 lbs./gal.	30—40 sec. 8.3—9.7 lbs./gal.

Well 2. In preparing for drilling the second well, four rock bits were "subbed" for use with the jet tubes recessed further into the subs in an effort to prevent the rapid wear experienced with the first "subbed" bits. This operation helped to obtain longer bit runs, but did not completely solve the bit problem. This problem may possibly be solved by applying hard surfacing material along the exposed area of the jet tubes. This was tried with varying results.

In the second well 302 feet of 8⅝-inch OD casing was set in 12¾-inch hole. Drilling commenced under surface casing, and a total depth of 4286 feet was reached in 66 hours drilling time with four bits mounted on jet subs.

After an electric log was run indicating no shows, it was decided to side wall core and drill stem test to determine if any unusual operating problems are involved in performing these tests.

Seven 5-inch wire line cores were taken at various points in the hole.

The drill stem test was successfully run, and the tool pulled out and layed down. No hole trouble was experienced in coring, or drill stem testing. As an indication of the hole characteristics, there was no circulation during the 15 hours of the test.

Table 3 contains drilling data for the second well.

Slim Holes Can Be Tested. From results obtained in these two slim holes it is indicated that 4¾-inch hole can be tested, logged and side wall cored without any great difficulty. These testing tools together with the aid of a mud logging trailer to log the shows and drilling breaks as they occur should furnish the necessary geological information to evaluate formations encountered. Since the success of the slim hole operation hinges on the ability to obtain and evaluate geological data, performance of testing equipment was very gratifying.

The anticipated drilling problems appear resolved by tests; there was no crooked hole problem—maximum deviation was 1¼ degrees on the first well and ¾ degree on the second; there was a decided absence of tight hole trouble and long periods of no circulation did not seem to have an adverse effect upon hole condition.

Bits still present a problem. However, with an increased demand, research and development no doubt will find the solution to better bearings, jet bit improvement, and other problems inherent to the use of the relatively small 4¾-inch bits. While good results were obtained from bits in the second well, jet tubes were still worn through.

Hydraulically it appears that from 140 to 120 gallons per minute at from

TABLE 2
Well #1 Drilling Data on 4¾" Hole Sec. 2-11N-5E Caldwell Parish, Louisiana

Run	Size	Bit Description*	Size of Jets	In	Out	Footage Drilled	Hours Rotated	Nos. Vel. Ft./Sec.	Ft./Hr.	Pounds On Bit	Rot. RPM	Dev. Degree	GPM	PSI.	Condition of Bit
1	12¼"	RB	....	0	330	330	5½	....	60	2000	....	....	....	....	....
2	4¾"	RB	3—¼"	330	1289	959	12	456	79.9	2-5000	110	¾°	210	1050	Sharp—Tubes Wornout
3	4¾"	RB	3—¼"	1289	2328	1039	21¾	296	63.9	2-4000	95	¾°	136	750	Sharp—Tubes Wornout
4	4¾"	RB-1	3—¼"	2328	2760	432	9½	283	45.4	4-5000	90	1°	130	750	Sharp—Tubes Wornout
5	4¾"	RB-2	....	2760	3305	545	20½	....	26.6	3-5000	95	1¼°	160	900	Dull—Bearings Fair
6	4¾"	RB-2	....	3305	3506	201	9¾	....	20.6	4-5000	90	¾°	156	950	M-Dull—Bearings Good
7	4¾"	RB	3—¼"	3506	4102	596	19½	292	30.6	5000	80	¾°	134	1100	Dull—Bearings Good
8	4¾"	RB	....	4102	4428	326	15¾	....	20.7	6000	90	½°	162	1150	Dull—Bearings Good[1]
9	4¾"	RB	3—¼"	4428	4494	66	4	301	16.5	6000	85	½°	138	1200	Sharp—Bearings Good

* **Abbreviations:** RB—Tricone Rock Bit for Medium Rock Formations. RB-1—Tricone Rock Bit for Medium Hard to Soft Formations. RB-2—Tricone Conventional Rock Bit for Hard Rock Formations.

TABLE 3
Well #2 Drilling Data on 4¾" Hole Sec. 26-12N-5E Caldwell Parish, La.

Run	Size	Bit Description*	Size of Jets	In	Out	Footage Drilled	Hours Rotated	Nos. Vel. Ft./Sec.	Ft./Hr.	Pounds On Bit	Rot. RPM	Dev. Degree	GPM	PSI.	Condition of Bit
1	12¼"	RB	....	0	315	315	6	....	52.5	3000	....	....	....	....	....
2	4¾"	RB	3—¼"	315	2218	1903	20¾	414	91.7	3-6000	80	¾°	190	1050	Med. Dull—Tubes Worn Out
3	4¾"	RB	3—¼"	2218	3353	1135	19⅓	301	58.7	5-7000	90	¾°	138	1100	Dull—Bearing Good—Tubes Worn Out
4	4¾"	RB	3—¼"	3353	3868	515	17	283	30.3	6000	95	½°	130	1125	S. Dull B.B.—Tubes Worn Out
5	4¾"	RB	3—¼"	3868	4286	418	12½	266	33.4	7-8000	90	¾°	122	1150	M. Dull—Bearings Good—Tubes Good

* **Abbreviation:**—RB—Tricone Rock Bit for Medium Rock Formations.

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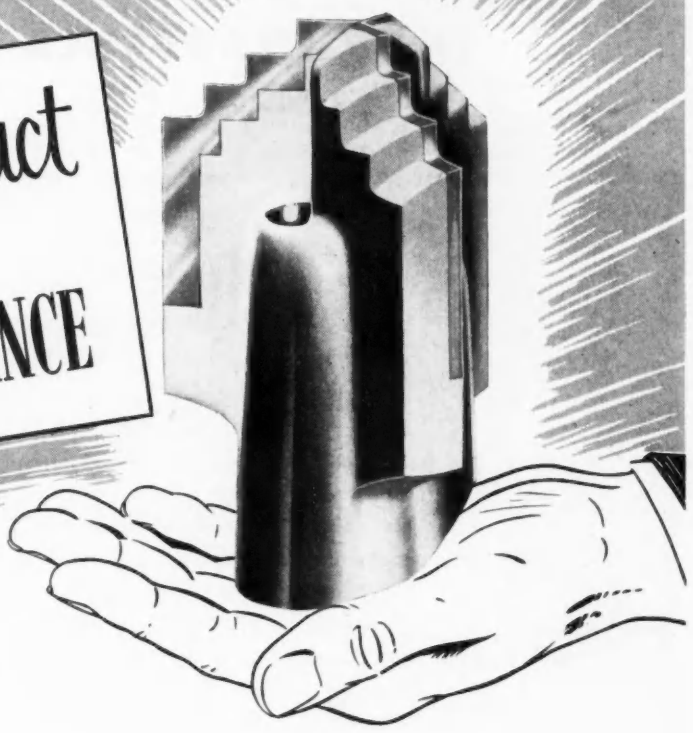

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100 to 1150 pounds per square inch while drilling with ¼-inch jets will perform the job satisfactorily although circulation rates approaching 200 gpm may be attained while drilling under surface casing without exceeding 1050-1150 psi.

Table 3 illustrates the relationship between circulation rate and pressures encountered during the drilling of the second well.

The recommended minimum jet nozzle velocities for the 4¾-inch hole are slightly in excess of 150 feet per second whereas the velocities attained in the tests ranged from 266 to 414 feet per second.

The satisfactory use of jet bits appears to be of prime consideration in slim hole drilling as it stands at present. Increased rate of penetration and better bit performance by jet bits will contribute a vital part in reducing drilling time and making the entire operation economically feasible.

Figure 1 shows graphically 46 hours drilling time improvement between the two wells with the majority of the credit going to the improved performance of the jet bits used. A working knowledge of formations to be drilled and a better understanding of expected bit performance were also deciding factors in reducing the drilling time.

The saving in drilling mud is another factor favoring the use of slim hole technique. After observing the formation characteristics on the first well drilled it was decided to use only a thinning agent below the surface on the second well. Other than spud mud the only mud additives on the second well were 50 pounds of tannic acid and 25 pounds of caustic soda to thin the mud. A moderate stream of water was used to help keep the viscosity between 30 and 40 seconds. Since the cuttings were composed of fine sand particles with small shale cuttings and because a mud logging trailer was employed no shale shaker was used. By thinning the mud with water and a small amount of chemicals, a rapid fall out of solid particles in the mud was secured and it was only necessary to provide sufficient pit arrangement for settling and cleaning to keep the solids carryover to a minimum.

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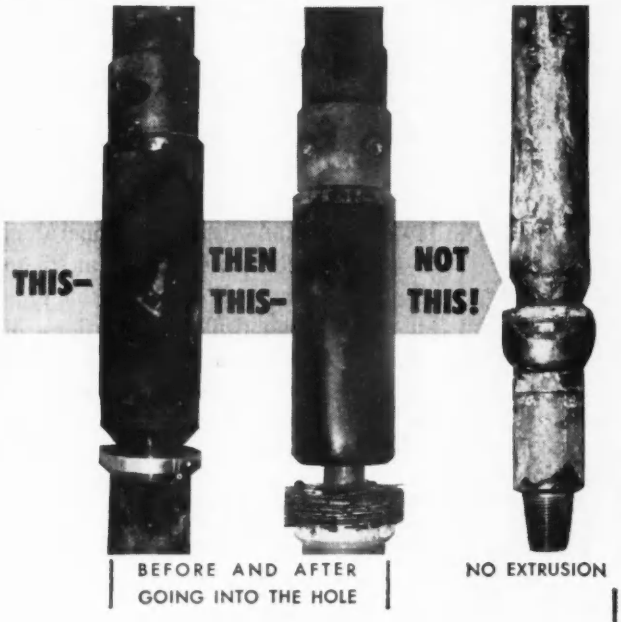

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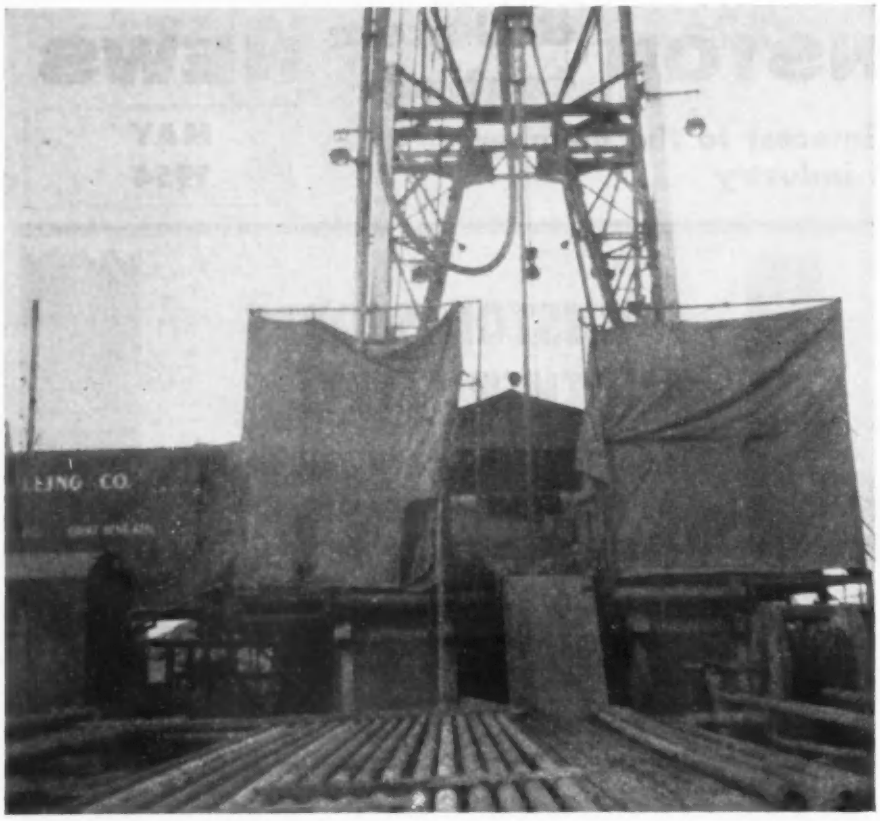


THIS STRIPPED-DOWN RIG drilled a 10,266-foot well, 4¾-inch diameter in Wyoming's hard-rock, crooked-hole country.

Drilling Slim Holes In Hard-Rock Country

Here's a contractor who has drilled several 4¾-inch holes below 10,000 feet and is convinced that slim hole may be the answer to cheaper drilling.

By HENRY B. BRACK, Vice President, Brack Drilling Company, Wichita, Kansas

Brack Drilling Company, Inc., of Wichita, Kansas, has gained vital experience in drilling deep "slim holes" with diamond bits in hard rock crooked hole country of Wyoming. One 4¾-inch well went to a total depth of 10,266 feet using 2⅞-inch outside diameter N-80 tubing as drill pipe with a conventional rig designed to go 4500 feet with 4½-inch drill pipe. This operation was drilled the same as a conventional "big hole" except more diamond bits were used.

In the absence of weight, it was necessary to compensate with some other means of cutting the hole. It was important to arrive at a balance between rotary table speed, mud pressure, and weight. Therefore, the rotary table was rotated up to 350 revolutions per minute, the mud pressure never exceeded 1800 pounds per square inch and the weight carried on the bit varied from almost nothing to 8000 pounds. Good penetration rates have kept it ahead of big rigs doing comparable work.

What is a slim hole? From the drilling contractor's standpoint, today's slim hole may be defined as any bore in the earth wherein the operator can satisfactorily test the objective formation with existing API equipment. From the standpoint of bit diameter this may vary from 7 inches through the sizes to 4¾ inches.

Slim hole objectives. There just has to be some way to find oil by less costly methods. Slim hole drilling may provide an answer. Many operators and contractors are aiming at 25 to 45 percent over-all saving in this type of exploration drilling operations. If the above estimated savings are realized, it means heretofore untested potential oil areas will be found and developed, thereby accelerating "big rig" activity. From the contractor's standpoint this is a major advantage and looks so overwhelmingly good that the few disadvantages presented by the slim hole technique amount to almost nothing.

Drilling experiences. Brack Drilling Company is deeply indebted to the foresight of one major company responsible for its venture into slim hole exploration drilling. The foresight of this company's management, engineers, and practical drilling tool people, within the organization is entirely responsible for Brack Drilling Company to continue in this phase of drilling. The ability of the operator and the contractor to openly and frankly attack the slim hole operation both economically and technically have been the primary cause for the success of this venture.

The drilling problems experienced have not been unsurmountable. The slim hole operations in Wyoming have been of an exploratory nature. The surface formations to 5500 feet are primarily shale, below which, a hard rock situation exists where drilling is in dense sands, limestones and hard formations which cause hole to go off vertical. Locations are complicated by the area being "side hill"

country. Much of the formation has 30-degree dip and weight is sacrificed for high rotating speeds. Diamond bits have been employed with a minimum amount of trouble. Three cone rock bits have been used successfully.

Hole deviation. In this area six-degree drilling contracts have been given on a sliding scale basis. This would mean that the contractor could be off 1½ degrees at 4000 feet, 2 degrees at 6000 feet, 3 degrees at 7000 feet and in all probability would not be off 6 degrees at 8000 feet. If deviation becomes prominent in the upper part of the hole it could be straightened before reaching desired depths.

Crews. Four-man crews have been employed during winter operations. It is anticipated that the use of three-man crews, drilling wells to 13,000 feet, will be investigated during summer months. This would represent a tremendous rig operating saving.

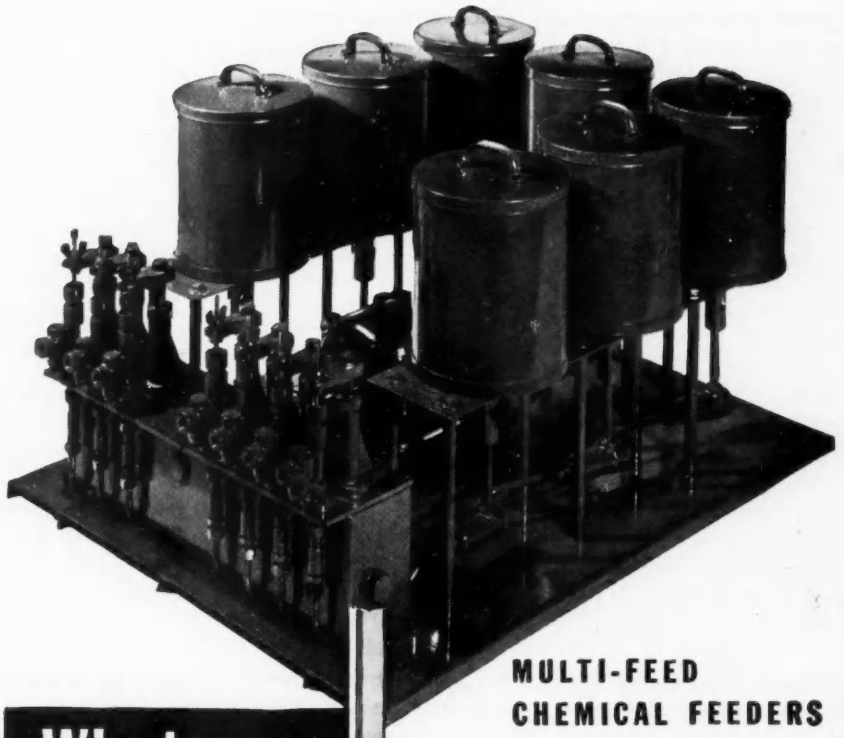
Drilling time. Compared to large rigs in the area, outside of lost circulation problems, the slim hole has led the field.

The 10,266 foot well was completed through extremely hard rock, using a new concave type diamond bit. The bit was on bottom for eight days while drilling a thick interval at 9000 feet. One advantage of the diamond bit was that it helped reduce trip time on the hole. "Big rigs" in the area average 24 feet of hole per day, compared to 57 feet per day with the slim hole rig, amounting to a substantial saving. In this hard rock area a rig which can make only a foot an hour, is not considered slow.

The pump pressure maintained below 8500 feet was 1700 pounds. The 7¼ x 12-inch pump has a working power capacity of 2000 pounds. A pump speed of about 45 strokes per minute was maintained.

Fast rotating speed of 275 rpm was used in hard formations with a great deal of success, even when compared to larger rigs in this area.

Severe mud conditions encountered were caused partly by fresh flowing water at 900 feet and partly because the hole was filled with drill stem and joints. To be more specific, with 2⅞-inch drill pipe accommodating 3⅞-inch OD tool joints inside of a 4¾-inch hole. The hole annular creates



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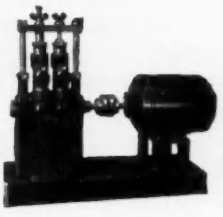

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a system of unequal pressures which cause breakdown of formations resulting in lost circulation problems. This problem has been particularly noticeable in shale formations.

An unusual bit problem has occurred when running through soft formations with regular three cone bits. On several occasions the bits have tended to pinch together.

Lost circulation material has been carried and this presents a problem when moving mud fast through a small hole. With high mud pressures inside of a small confined annular space, it is remarkable that only two or three times has the shale shaker been bypassed.

No logging difficulties out of the ordinary have been experienced. Bridging is as apt to happen in a small hole as in a large one.

Contractor's costs. Various type slim hole drilling contracts have been made, and will vary according to the locale. Many contractors and oil companies feel that slim hole drilling is still in an experimental phase. For the present, a percentage type contract based on day rates is desirable to both the contractor and the operator. This percentage is between 25 and 40 percent depending on locale. After one "lays the figures down" for capital investment necessary to equip a rig for slim hole operation and the risks, the conclusion will be that the most equitable agreement must be either a "formation contract" or one based on day rates.

There are some areas in which slim holes can be drilled on a contract basis. This has been done successfully in the Denver-Julesburg Basin. In areas where formations are known, the risk of using a slim hole rig will be minimized.

As far as the Rocky Mountains are concerned—particularily in the Big Horn Basin, Williston Basin or Powder River where comparatively few wells have been drilled compared to the size of these basins—the drilling contractor is asking for trouble to accept a footage contract.

Fishing problems. Slim hole fishing problems have not been out of the ordinary. On the first deep hole frequent pipe failure occurred because of the method tool joints were applied to 2⅞-inch drill pipe. At one time 5000 feet of pipe fell 4000 feet to bottom. Pipe had broken straight above the upset and fish was caught. Should the drill stem be broken five feet below the pin, it can be recovered with a regular overshot.

Admittedly there is not much room in a slim hole to work, but by the same token the drill pipe doesn't have much room to swing. If the pipe is broken in the drill collar, spears can be used. Cable tool spears have been found to do an excellent job.

Mud program. In hazardous drilling areas slim hole rigs should be equipped with mixing equipment that permit rapid mixing yet carry a total mud capacity of only 240 barrels for portability. On the deep well, mud weights of 9.7 to 10 pounds per gallon have been carried, while viscosity has averaged 47 seconds.

Are operators ready to accept slim hole? Should the contractor invest capital in slim hole equipment with the hope that the oil industry is ready to accept this method of exploration? This is a major decision. Contractors don't know in what light companies view slim hole.

Some major companies have assisted the contractors in investigating slim hole drilling. Some oil companies feel that company rigs should be used until such a time as slim hole is out of the experimental stage. Others believe it will take the cooperation of the contractor for mutual benefit. Many companies are considering slim hole as a significant inexpensive exploratory tool, while a few believe slim hole development wells are greatly in the picture.

The contractor must first realize that slim hole drilling is not just another device to spend money in the exploration field. Actually slim hole drilling has been instituted to save money. Any good used rig in the 4000 to 5000 foot class can be put to work on a slim hole and can drill from 10,000 to 13,000 feet with 2⅞-inch drill pipe.

(Editor's Note: See the converse of this statement in MacDonald's article this issue.)

Of course, there are component rig essentials besides a mast that pulls doubles and drawworks as mentioned. These are adequate pumps, mud tanks, substructure, etc., and other equipment depending on locale; however, the contractor, to perform the best drilling operation at the lowest cost, must revise his thinking when it comes to deep slim hole drilling.

The most important single item to consider is portability. Rig up a 13,000-foot rotary that is mobile and can be moved with ten trucks or less. The intent of a slim hole is to save 35 to 40 percent on exploration drilling. Don't over-equip a slim hole rig because overweight and, in the general aspect, capital investment and time increase the daily cost of rig operation. In the writer's opinion the advantages of slim hole drilling outweigh the disadvantages. The first advantage to consider is cost. A safe estimate would be 25 to 45 percent over-all saving in the exploration drilling operation.

The prime disadvantage at this point is developing the "know-how" to drill slim holes. This covers all phases of the total drilling operation, engineering technique, orientation of labor, mud program, fishing tools, and type of bit.

Future deep drilling. How deep can you drill? This question is just as logical to the big hole driller as it is to the slim hole driller. You can go just as deep as equipment, mud, and hole condition will allow.

(Editor's Note: See hydraulic study elsewhere in this report.)

The writer is of the opinion that within the next three to five years slim holes, five inches or less, will be drilled to depths exceeding 20,000 feet. This viewpoint simply means that it is quite possible that within the next few years any exploration well with a projected total depth of 10,000 feet or more will be drilled slim hole.

Problems of drilling. There are problems confronting the operator and contractor on any type of hole that is projected.

A "slim hole" problem is manpower. This does not seem insurmountable. However, when men work with a highly mobile factory, such as, a slim hole rotary rig, they are subject to a great deal of moving, usually to isolated spots. Also some men resent a transfer from conventional to slim hole rigs.

Another problem will be the availability of drilling material and third

party services. The great and continuing strides mud engineers have made in the past ten years will be of great importance to the successful completion of many "slim hole". From experience, findings indicate that considerable improvement will and can be made in the type drill stem and tool joints now in use. Next and just as important is the need for a three cone rock bit with bearings that will stand up.

Mud engineering problems are aggravated due to filling up the hole with drill stem and tool joints creating a system of unequal pressures in the annulus which cause formation breakdown with resultant lost circulation problems.

Other problems such as rotary table speed, weight, and mud pressures will have to be worked out during actual drilling as these conditions will vary.

Can slim holes be completed? To deepen an old hole by drilling inside 5½-inch casing, the present method is to achieve total depth and run a 4-inch liner. The possibility of drilling a grass roots well arises if an oil show is encountered at 8000 feet. It must be determined from the drilling record which is the most economical move—ream down or twin the well. There can be no rule of thumb in this instance as each individual exploration well will have to be treated separately.

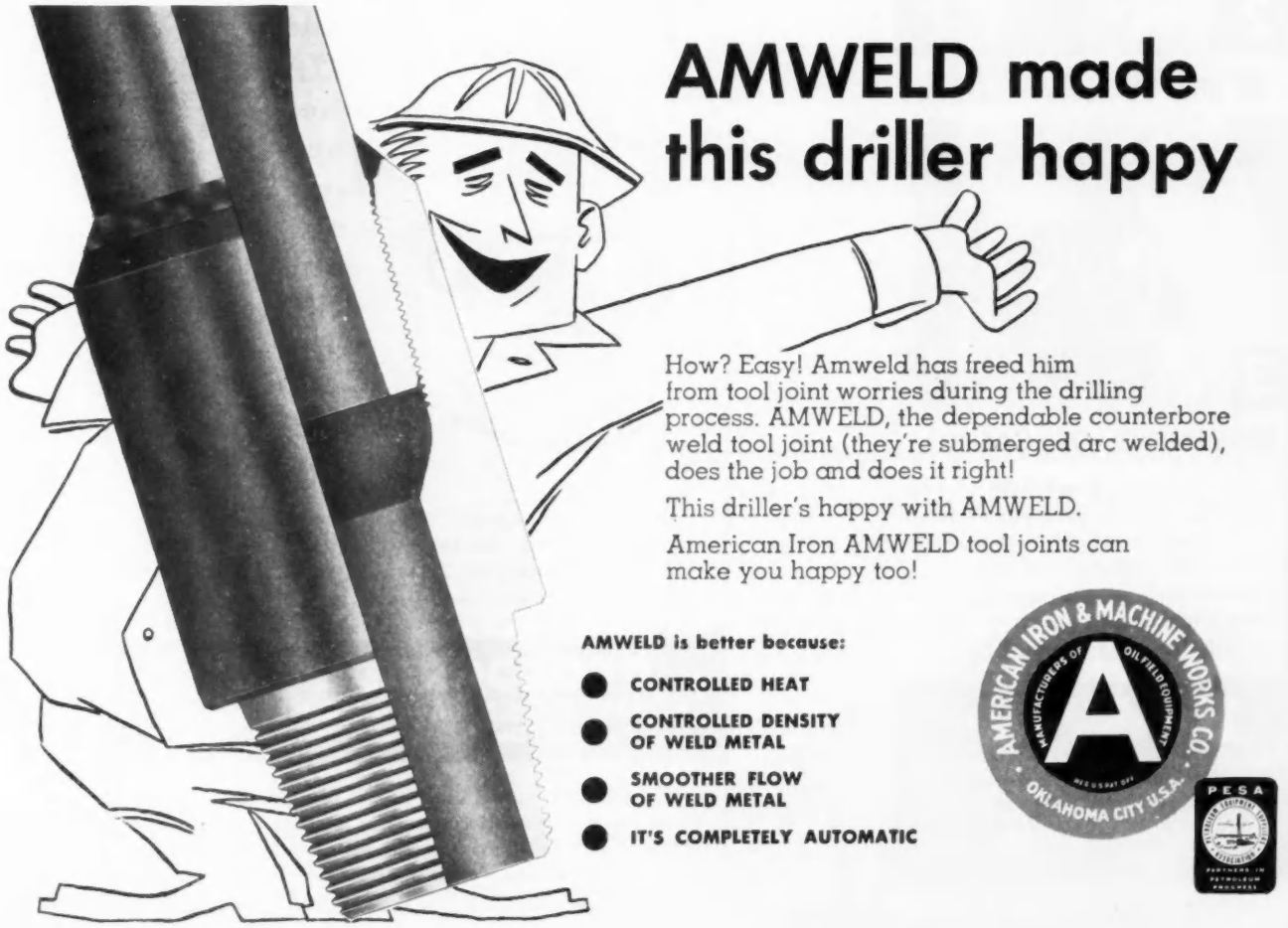
Slim Holes will be completed. There has to be a cheaper way.

Something is being done . . .

SOME PRACTICAL and specific plan must be devised to show any steady improvement in either the cost of drilling or a further reduction in accidents. Several companies, including Shell Oil Company, are taking a rather radical approach to the problem of reducing stratigraphic drilling costs. Some believe one of the more practical approaches of reducing oil prospecting cost is to drill a much smaller hole, using smaller equipment so that there will be a real reduction in basic daily operating costs. If these basic operating costs are 50 percent lower than for a standard rig and if the drilling and technical people can raise rates of penetration to approach that of a standard rig, then drilling costs will be substantially lower. Also, with a small rig, attendant cost of bits, mud, depreciation, moving, rigging up and tearing out, are also greatly reduced.

Currently, Shell is conducting an experimental program which includes an attempt to drill holes on the order of three inches in diameter. Other companies are experimenting with 4¾-inch hole size. This shows that drilling people have attacked the problem of reducing stratigraphic drilling cost with a definite proposal that, if successful, actually will reduce their cost. In other words, they are attempting to do something more than just talk about the need of reducing cost.

From a talk presented at the National Safety Congress, Chicago, Oct. 22, 1953, by Bill Bates, general superintendent of drilling, Shell Oil Company, Los Angeles.



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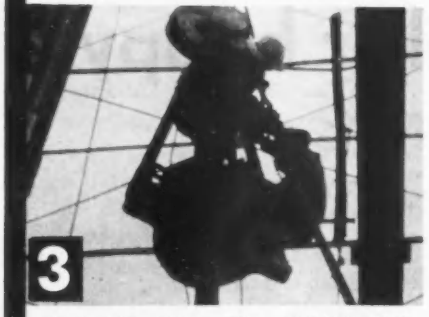

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A Special Report on Slim Hole Drilling

How to Convert a Rig

Here's what can be done to a conventional workover rig to adapt it to slim hole drilling.

ONE MAJOR COMPANY is studying the practicality of operating a slim hole rig in the Permian Basin by converting a conventional workover rotary rig to a slim hole application.

Consideration has been given to crew size, hoisting requirements, height of mast, block loads, hydraulic system, rig portability, desired hole size, type drill pipe, and blowout equipment.

The rig is a conventional trailer mounted workover rig with a light mast permitting drill pipe to be pulled in singles only. This will be changed in favor of a 150,000-pound capacity double telescoping derrick.

Used drill pipe will be replaced with 2⅞-inch outside diameter N-80 tubing as drill pipe, with some type of shouldering tubing thread instead of tool joints. Efforts are being made to minimize large pipe investment should pipe be lost in the hole. A calculated risk is expected.

A trailer mounted air tubing spider and tubing tongs will be used on the drill tubing.

Plans are to use a three man crew —a driller, one rotary helper, and

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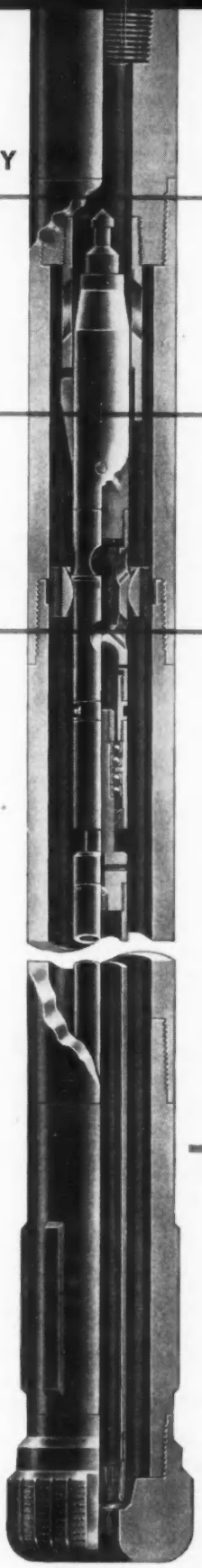

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one derrickman. This crew is sufficient for the tubing will be handled with power slips and tongs and drilling will be done with a diamond wire line core barrel.

Hole size has not been decided at present, because available diamond bit sizes limit size to 4¾-inch hole. One diamond bit company makes a 3¾-inch OD barrel and a 4¼-inch bit to cut a 1½-inch core.

(Editor's Note: Barrels are available on special order, for a 2¾-inch bit to cut a ⅝-inch core.)

Surface casing will be 7⅝-inch and will accommodate the 4¾-inch or 5-inch bit planned for this program. It is felt that the depth to which a well can be drilled will be increased in hard rock country because the risk is minimized. Depths in excess of 7000 feet are contemplated, and the coring information will be used by the geological department in conjunction with their seismic work.

No wells will be completed as producers in case of commercial production. The plan is to plug the slim hole and move in a rig suitable to drill proper size hole, since this company feels that reaming a 5000 to 6000 foot hole from 5-inch to 7⅞-inch would not be practical.

(Editor's Note: The idea that a slim hole cannot be completed is contrary to the thinking of other people at this time. More on this subject appears elsewhere in this report.)

Principal equipment will be a conventional workover rig, trailer mounted drawworks with the telescoping derrick powered with a diesel engine. Two 5-inch by 10-inch pumps rated at 1500 pounds per square inch maximum working pressure powered by two diesels, power tubing tongs and air spider, a 100-ton block and 75-ton hook unitized, a high-pressure swivel, and a six-inch double gate blowout preventer. The pumps will be arranged for paralleling to give adequate volumes of fluid for ordinary drilling operations.

With the above hookup, the overhead load (block and hook weight) would be 4400 pounds to drill a 6500 foot well, whereas 15,000 pounds to 17,000 pounds would not be uncommon on a larger rig for the same depth. The hook load would be reduced considerably using tubing weighing 6.5 pounds per foot against comparable drill pipe weighing 10.4 pounds per foot. The well would have to exceed 10,000 feet before the hook load would exceed the rated derrick capacity.

Portability is an important item in slim hole work. Transportation costs run around $6500 or more to move a large rig 200 or 300 miles in West Texas. The objective is to reduce moving costs drastically by packaging the slim hole rig in 6 to 8 loads.

Operating costs should be cut in half over large conventional rigs.

(Editor's Note: A sample calculation to indicate the moving and operating comparison on a large rig and on a slim hole rig is given elsewhere in this report.)

This slim hole rig may make an excellent exploratory program possible for the same amount of money now being spent. **The End.**

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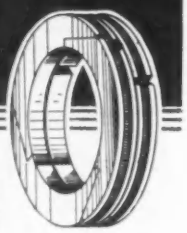

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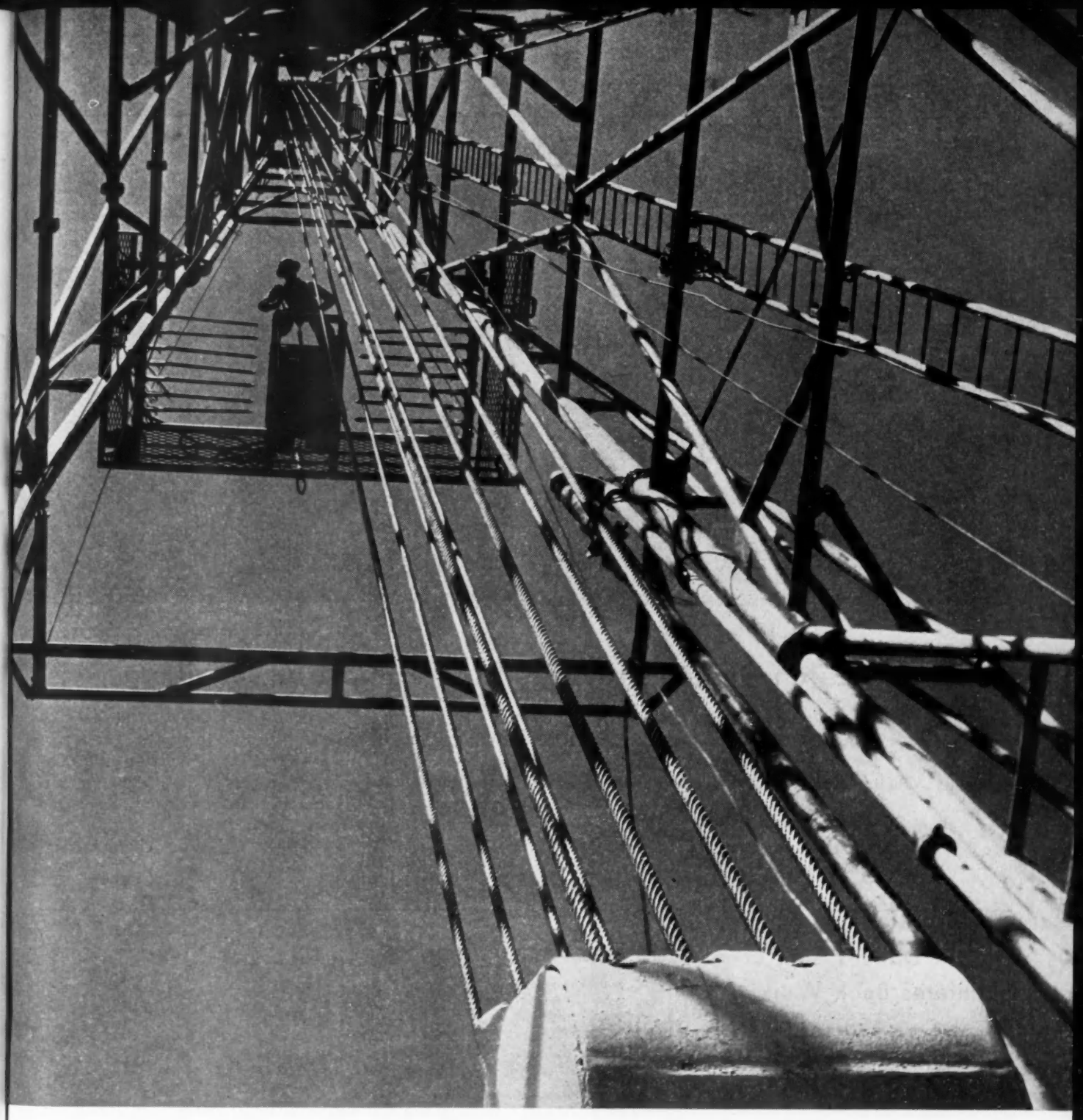

Wire Rope at Work—It's quite a trip up there to the "penthouse," where the wire rope curves around the crown sheaves. But it's a lot farther to the bottom of the hole, which in this case is more than two miles underground. And to the wire rope falls the task of handling the long string of drill pipe, a temperamental load of many tons.

The rope selected for this particular job was 1⅛-in. Bethlehem 6 x 21 Seale. It was Purple Strand, of course—Bethlehem's toughest, most wear-resisting grade—with IWRC and the Form-Set (preformed) construction. A logical choice for the work involved, and the loads were easily within the capacity of this stable, high-strength rotary line.

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FIGURE 1

FIGURE 2

Chain and Latch Device Prevents Mud Pump from Walking

Laughlin and Porter Drilling Company devised a method of preventing the mud pump from "walking" when driven by V-belts from derrick floor level.

Old chain tongs are welded on one side of a fork that has been machined with a latch to accommodate the chain. By passing the chain around the pipe brace of the mud pump skid, it can be latched in place as shown. Square threads on a pin joint make up on a special long coupling, allowing regulation of proper tension.

Figure 1 shows the brace framework which is made from 3-inch pipe. The frame is bolted to the ends of the substructure as shown. The frame can be rotated in the slip joint connection so that it may be swung and bolted to the substructure when the rig is skidded.

Figure 2 shows the chain latched in position.

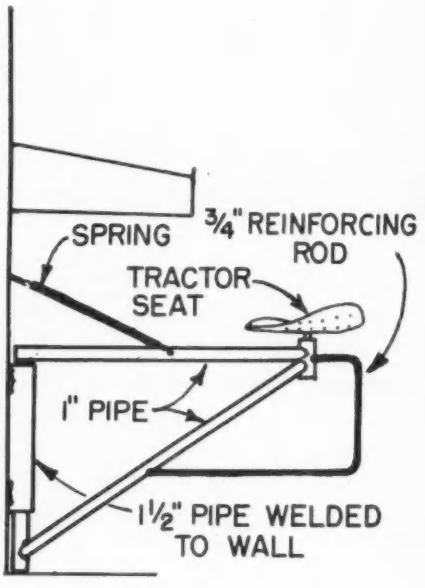
Hinged Driller's Seat Facilitates Book Work

Gus Glasscock Drilling Company of Corpus Christi, Texas, has fabricated a "swinging door" type seat for the doghouse desk. Built in the shape of a bicycle frame with a tractor seat replacing the handle bars, the seat is convenient and sturdy.

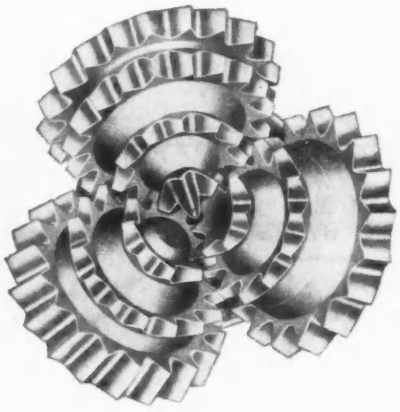
Weld 1-inch pipe in the triangular shape shown in the diagram. Weld a short length of 1½-inch pipe vertically to the doghouse wall to provide the pivoting support for the seat frame. Slip the vertical section of 1-inch seat frame through the 1½-inch welded pipe and weld the horizontal bar to the supporting brace.

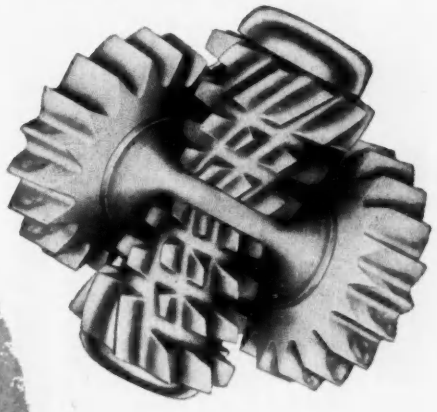
Weld an old tractor seat in place at the intersection of the horizontal bar and the brace. A ¾-inch reinforcing rod welded as shown gives added rigidity.

Attach a door spring to the wall and to the horizontal bar of the frame, allowing the seat to swing out of the way under the "knowledge box" when not in use.



DDT—For long runs and greater footage in top formations—chalk, red beds, top shales and unconsolidated sands.





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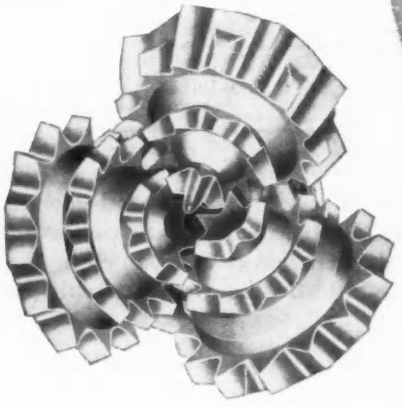
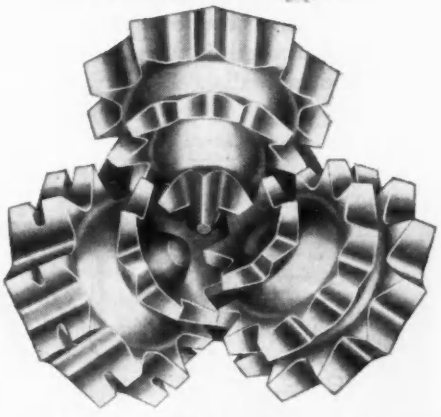
3C-2—For maximum action in harder, sharper formations—sandy shales, dolomite, hard lime and sandstones.

K-2P—Rugged, long-tooth bit for medium to harder shales, chalks, red beds, limes and some conglomerates.



3C-K2—Designed for drilling soft to medium formations with streaks or layers of harder formations.

4—For maximum service under heavy weight in granite, chert, the harder sands and shales.



3C-DT—Fast-drilling, long-tooth bit for shales, anhydrite, chalk, medium limes and unconsolidated formations.

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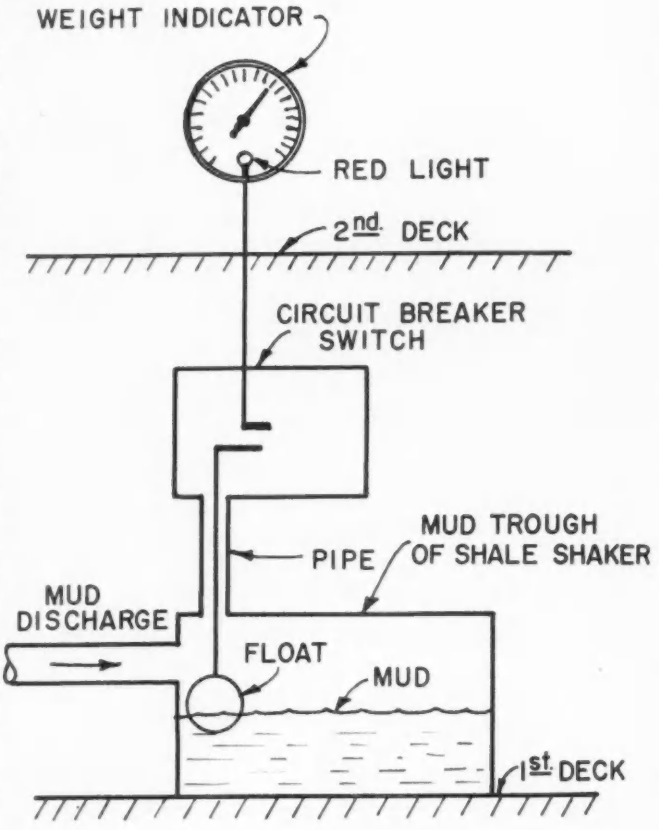
Homemade Alarm Signals Mud Loss

One drilling contractor in the Southwest Texas tidelands has designed a homemade mud alarm which can be used to warn the driller of approaching loss of mud to the formation.



Built on top of the mud trough of the shale shaker, the alarm principle is based on the following: mud from the wellhead discharges into the mud ditch of the shaker where the fluid is controlled by a baffle plate. A metal float rides the fluid level. A five-foot length of small diameter rod inside a small diameter pipe connects the float and the circuit breaker above. An electric cable connects the circuit breaker with a red light built into the weight indicator dial.

When the fluid level falls below its desired level, such as is the case when lost circulation is encountered, the float falls, breaking contact with the

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You can mix mud to just the weight and viscosity you want—so fast you won't believe it until you see it work.

You can do it with a small fraction (as little as one-tenth) of the horsepower normally used for mixing mud.

And you can save up to $5,000 per year on maintenance of your mud mixing equipment! Results prove it.

Heavier mud—in seconds. To keep mud uniform, you just use one (or in large installations two) LIGHTNIN Mixers—self-contained units specially designed for this job.

To get heavier mud, you flash-mix weight material into the mud entering the tank or pit. Flash mixing is done by a small high-speed LIGHTNIN unit, mounted at the inlet.

Mud is then circulated rapidly and uniformly throughout the tank or pit by a turbine-type LIGHTNIN Mixer mounted over the mud.

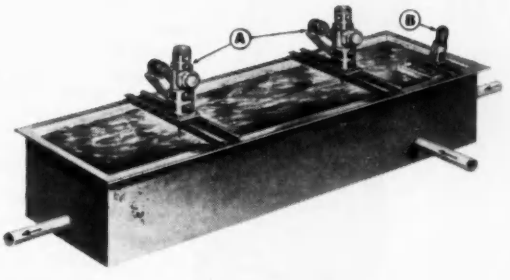
You can add weight material sackful after sackful—as fast as you want to dump it in. You get an *immediate* rise in weight, throughout the whole mud system. A few seconds is all it takes to increase weight of every gallon of mud by the exact amount you want.

You get immediate dispersion of gel ingredients—and in 20 minutes you get fully uniform viscosity.

You keep the entire contents of your mud tank or pit in a perfect state of mix—ready for instant use. Mud characteristics stay *constant*—right where you want them, for best drilling. No mud settles out in the corners of the tank or pit. This saving in mud cost, alone, has amounted to thousands of dollars per location.

Make savings like these. On a new rig, you can eliminate the entire cost of a standby pump, its prime mover, and component piping for jetting mud.

On any rig, new or old, you save *two-thirds or more* what it costs you now to replace pump parts, valves, and fittings worn out in mud agitation service. The only parts in contact with mud are the LIGHTNIN Mixer impellers—built to resist abrasion, yet easily replaced at any time for a fraction of your present maintenance cost.



UNIFORM MUD—in a hurry. Weight and gel dumped in at the LIGHTNIN Flash Mixer (B) are distributed through mud IN A FEW SECONDS by one or two turbine-type LIGHTNIN Mud Mixers (A).

And you can cut your power consumption by about 90%, as compared with conventional mud agitation methods! The entire mixing job takes only 10 to 25 horsepower, depending on size of your tank or pit.

See for yourself. LIGHTNIN Mud Mixers are unconditionally guaranteed to do the mixing job *right* for you. But don't take our word for it—*see for yourself* what LIGHTNINs are doing on rigs in your part of the country. Your nearest LIGHTNIN sales engineer will gladly arrange a demonstration for you—without obligation, of course.

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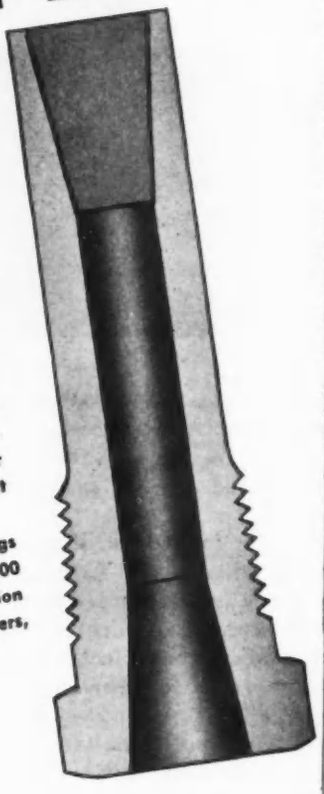
The ¾"x4" Fusible Plug provides additional protection. It will melt out at approximately 450 deg. F. When it melts-out it leaves approximately 9/16" of water over the crown sheet to prevent damage.

All Weco Fusible Plugs are kerosene tested to 1000 lbs. pressure. For protection and safety of your boilers, use Weco Fusible Plugs.



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¾" x 3"	1085	10 oz.
¾" x 3" Lg. Thd.*	1097	10 oz.
¾" x 4"	1079	12 oz.
¾" x 4" Lg. Thd.*	1095	12 oz.
1" x 2-3/16"	1089	12 oz.
1" x 3"	1083	13 oz.
1" x 4'	1077	16 oz.

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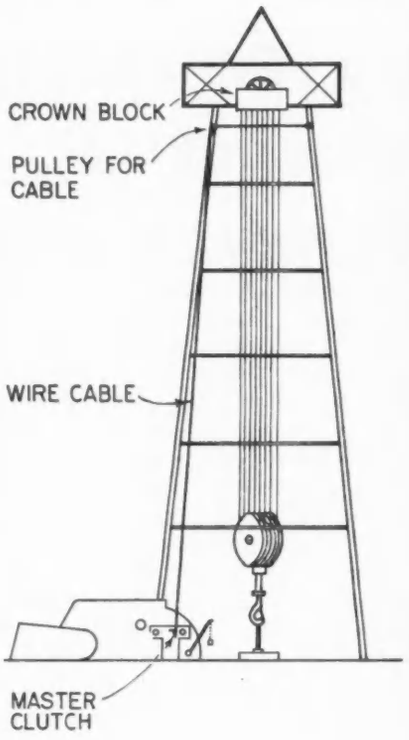
circuit above. Immediately a red light goes on to warn of approaching trouble.

This system is well adapted to barges where the mud system is on one deck and weight indicator is on the deck above. It can be used on any type rig.



Cable Prevents Blocks From Hitting Crown

A drilling company at Vivian, La., has devised a method of preventing the traveling block from running into the crown block. Damage that could result is prevented by a cable release that throws the master clutch on the drawworks.

A drawing shows how the small diameter wire cable is strung up one side of the derrick to a pulley fastened a few feet below the crown block. The cable is stretched through the pulley and is clamped securely to the opposite side of the derrick.

The loose end of the cable is then bolted to the master clutch handle. If the blocks should touch the wire during operations when going into the hole or when pulling pipe, the pressure on the cable will cause the release of the master clutch, thus providing a safety device for the rig.

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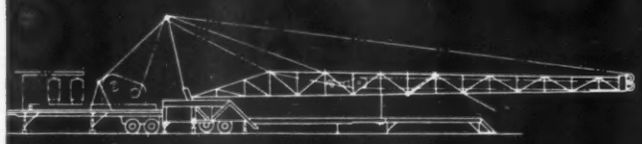

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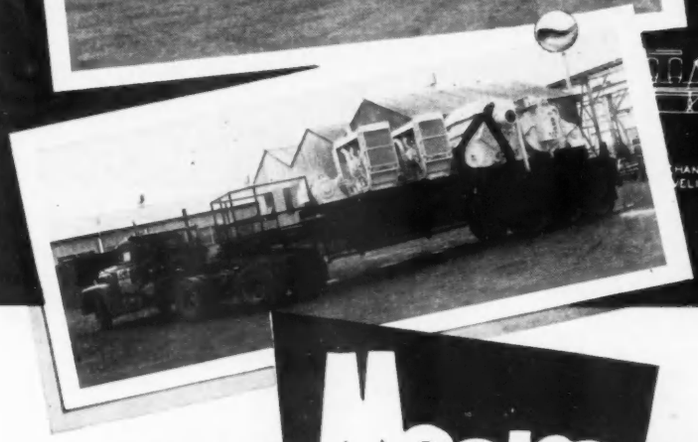

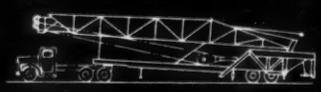

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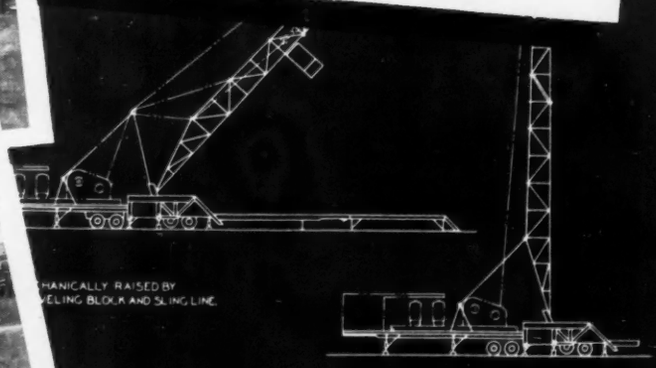

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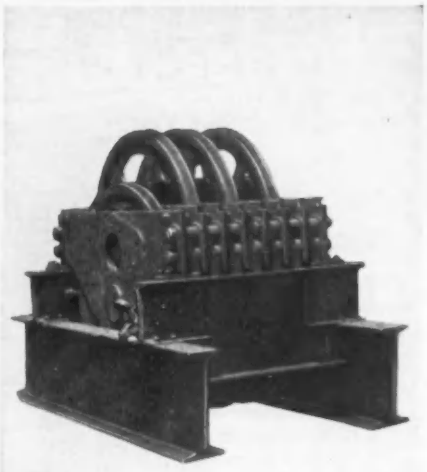

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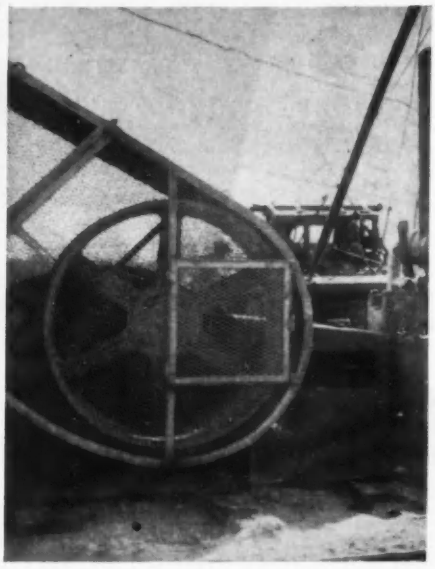
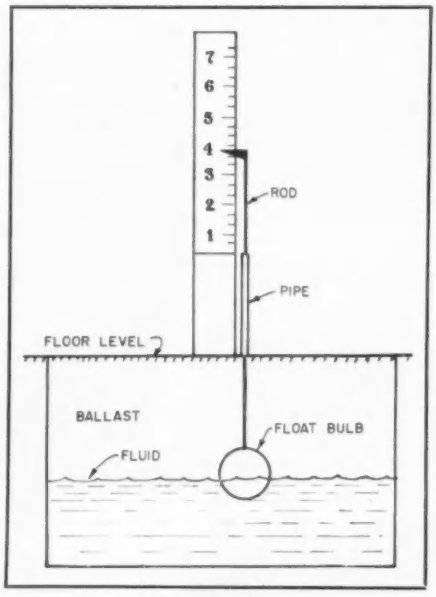


Pump Flywheel Guard Door Aids V-Belt Replacement

One West Texas drilling contractor built a 2-foot square angle iron door on the mud pump flywheel guard which aids in replacing V-belts when the pump is driven from engines on the derrick floor.

The door is made of angle iron with steel hinges welded to a center upright brace as shown. The opening is large enough to permit inspection or replacement of the V-belts, without removing the large belt guard.



Ballast Fluid Gauge Indicates Water Level

One major company has incorporated a ballast fluid level gauge on a drilling barge which is convenient and foolproof. A float bulb rides on top of the fluid level, below the deck flooring. A metal rod 10 feet long is welded to the metal bulb on one end and to a pointer at the upper end. The rod rides inside of a small diameter pipe to a point three feet above the floor level. From this point to its highest level, the pointer rides a metal channel or I beam.

Numbers are painted or bolted to the structure members supporting the decking of the barge. As water is let into the ballast the bulb rises, causing the pointer indicator to rise.

Visual inspection readily tells a crewman the level of water in the tanks below.

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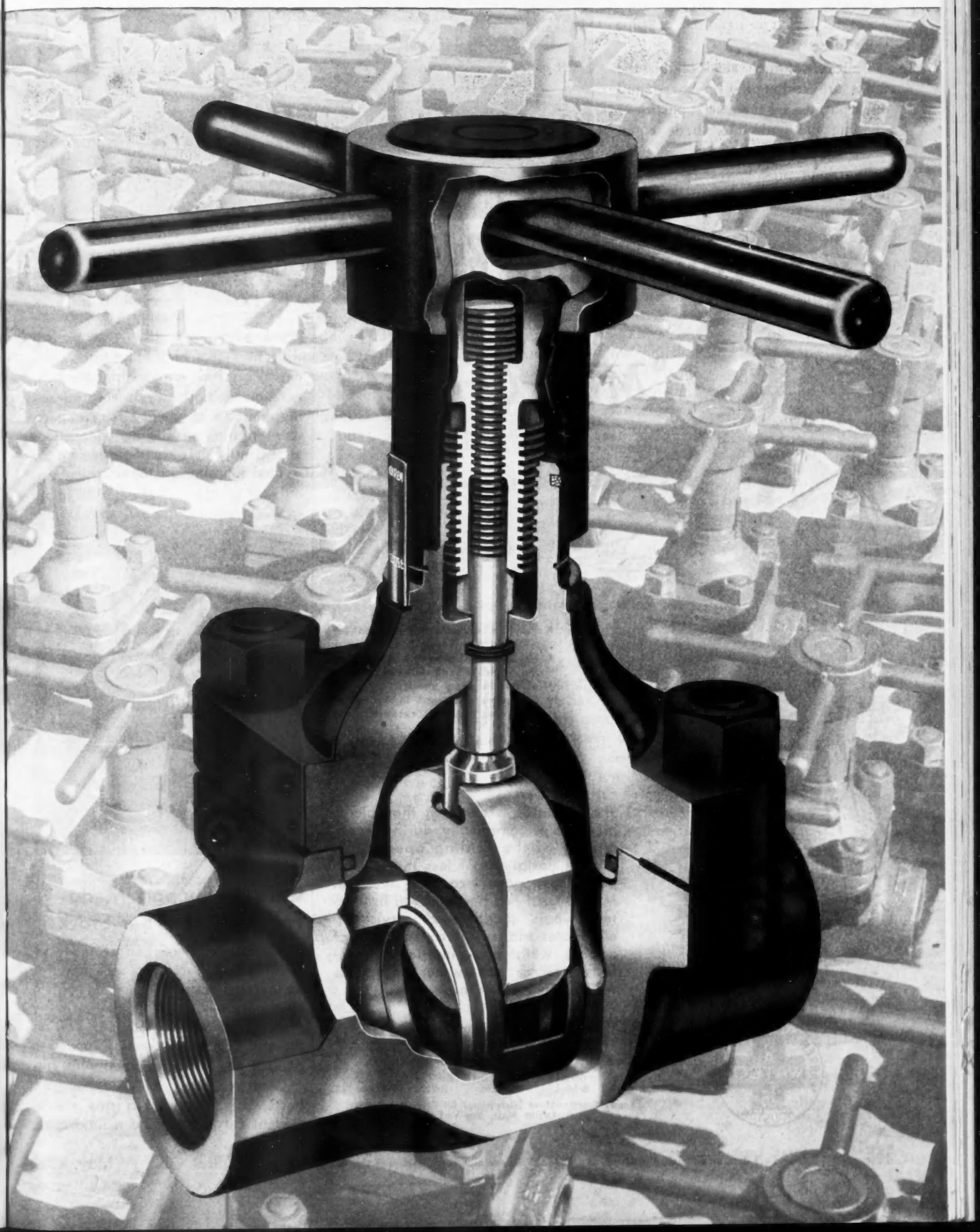
Rockwell-Built Mud Valve

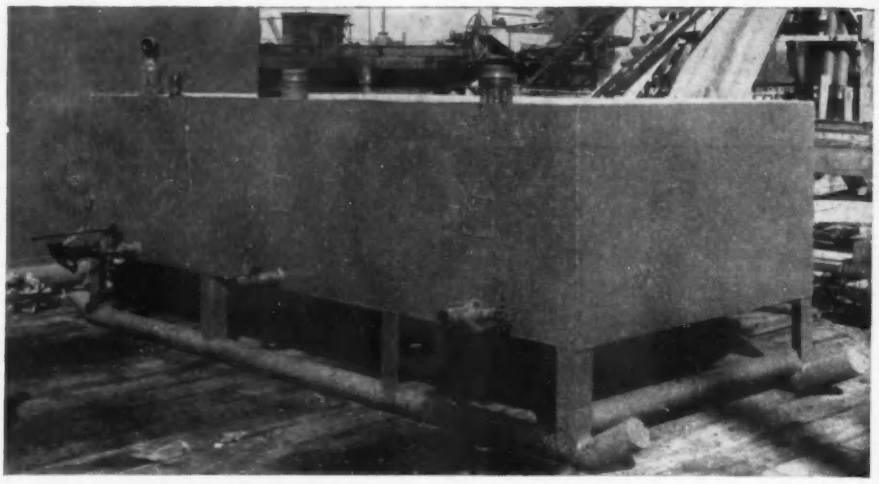


Fuel Storage Tank Is Skidded for Moves

One Louisiana drilling company has made a lubricant and fuel storage tank which is mounted on pipe skids for easy moves.

Built of ⅜-inch steel plates, the tanks are rectangular in shape and are separated by three steel partitions dividing the tank into three equal volume containers.

Four-inch pipe serves as the skid base. Two-inch angle irons serve as the legs which support and are welded to the storage tank above and the skids below.



The over-all measurements are approximately 12 feet long by 4 feet wide by 3 feet high. The three compartments have two-inch valve connections on both sides for withdrawing desired fuel or oil. Each compartment has two refueling connections at the top. Fuels are identified by the welded marking on the outside.

KEEP YOUR MUD IN BALANCE

with

"Mud-O-Graf"

- Provides accurate information for uniform mud control.
- Helps prevent blowouts by showing the duration and relative amount of gas in gassy streaks.
- Eliminates guesswork in the use of weighting materials, chemicals, and water.
- Indicates graphically all heavy and light streaks in the circulating system.

The condition of mud in the hole is recorded automatically during every minute of the drilling operations. Weight variations of less than 1/10-pound per gallon can be detected. Mud-O-Graf has been proved in fourteen years tough field service. It eliminates trial and error methods of adding weighting materials. It detects gas or salt water incursions which could cause blowouts.

WARREN AUTOMATIC TOOL CO.

Manufacturers of Pit-O-Graf and Rig Runner.

Houston CHarter 4444 | Odessa 6-5861 | Lake Charles 6-2265 | New Iberia 2-7131 | Harvey Edison 3721

Export Representative: International Oil Equipment Co.
30 Rockefeller Plaza, New York City

Catwalk Support Made From Welded Bar Stocks

Catwalk supports can be made by welding bar stock into the shape of an inverted figure 4. A hook is formed on the leg of the 4 so it may be hung over the edge of a mud tank and on the end of the horizontal support to prevent rig boards from slipping off.

Connecting several of these supports with boards provides a convenient catwalk around a mud tank.

Well Completion Technology . . . an Engineering Achievement

The manner in which a well is completed may determine the difference between a good or poor producer, or if it will produce at all. This is just a change of pace from the old lament "The well just won't produce." In either case, the oil was in the formation, but due to improper practices, the completion was not compatible with the physical and chemical characteristics of the reservoir.

It took the oil man a long time to recognize the relationship between completing the well and production characteristics of the reservoir. But thanks to strides made in reservoir engineering, a far better understanding exists about fluid flow mechanics as they pertain to the production of petroleum. Therefore, the reservoir itself dictates to a large degree the manner in which a well is completed.

If the oil sand contains any bentonite, water should not contact the formation. There are hundreds of do's and don'ts in completing wells, depending upon the reservoir. And, since there are no two oil fields alike . . . and in some cases, not even two leases exactly alike . . . each completion is a separate problem and must be considered as such.

•

Because so many factors enter into the selection of an optimum completion, this field is rapidly becoming a science in itself. We all know of "problem" wells in which successful drill stem tests started a chain reaction of high hopes. Core analysis and electric logs backed up the test. But, when the well finally was completed, the production record was disappointing. And how many wells do you know about where adequate saturation existed in a sizable section, but the well had to be swabbed and swabbed for days with only a few barrels of oil produced.

What happened? Why won't such wells make good producers like they should? The oil is there. And, why are wells on one side of the road pumping just a few barrels a day, while those on the other side of the road are flowing their full allowable? For the most part, the answers may be found in one of the most up-and-coming fields of technology . . . that of well completions. This new field consists of a combination of reservoir engineering, mechanical engineering, petroleum engineering, economics and sound practical experience all thrown in. A few large companies have separate groups who specialize in this field alone. But, a large majority of wells drilled annually in this country are not completed with the recommendation and counsel of such specialists. Normally, one or two individuals design the completion program, and this is usually the manner in which neighboring wells are completed. Sometimes this procedure turns out satisfactorily; and sometimes it does not. Not only must the reservoir be given prime consideration in planning a well completion, but the pure mechanics must also be included. And too, there is the matter of economics. What about the day when the well must be put on artificial lift . . . how about working the well over? And there are other factors, to be sure.

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Recognizing that the problem is one of major importance, the API Division of Production has established committees in its various districts to study it. The Mid-Continent District Study Committee on Well Completions is among those which have been organized for this purpose. It has done an outstanding job in organizing the problem, cataloging the possible solutions, and arriving at a system which offers considerable help in the selection of an adequate completion program to meet most well conditions.

A report on this subject was presented at the Spring meeting of the Mid-Continent District at Oklahoma City on March 19. At the same meeting, Marshall C. Turner of Phillips Petroleum Company, presented one of the most comprehensive studies yet to be made public on dual well completions.

Because the editors of WORLD OIL feel that these two papers are of industry-wide significance, and because they offer some practical aid to a universal problem, both manuscripts are published in full.

We wish to acknowledge with gratitude permission of the API Division of Production to reproduce both papers, and to congratulate the Mid-Continent Study Committee on Well Completions and Turner on important contributions to the technical oil literature.

J. E. KASTROP
Production Editor.

Mid-Continent Study Committee tells . . .

How to Select Well Completions

A report on 'Organization of Procedures for Selecting Well Completion Methods.'

The Mid-Continent District Coordinating Committee set up a Completion Practices Study Committee to "acquaint more people with more of the factors that should be considered in selecting a completion program." The Committee is composed of representatives of some 20 companies and organizations. It intends to set forth as fully as possible the various phases that enter into the selection of a well completion method, and to provide a guide for weighing factors for and against selection of alternate practices that may be used under different circumstances. The committee's report is not intended to tell how to complete a well, but only to aid in weighing possible choices, as well as to provide a means of evaluating procedures selected. This report was made before the Spring meeting, Mid-Continent District, API Division of Production, Oklahoma City, March 19, 1954.

This master chart was designed to aid in selection of well completion methods

By HAROLD M. DUNSON, Stanolind Oil and Gas Company, and
JOHN E. ECKEL, The Carter Oil Company, Tulsa

COMPLETION OPERATIONS are those that occur from the time the drill first penetrates the pay zone until the well is placed on routine production. Some of the completion decisions must be made before the hole is started in order to coordinate and plan the drilling program. Responsibility for recommended decisions may rest individually or jointly with the production personnel, reservoir engineering personnel, drilling personnel, and general management. Figure 1 sets forth the general order in which these problems present themselves. The brackets to the left indicate the class of personnel involved in the choices to be made. Also, note that the choices to be made are indicated as applying to a proved producing area. A wildcat would be similar to the extent that areal information on geology, probable producing sands, and general data from nearby fields or wildcats can be applied.

The initial choice indicated by Figure 1 is the type of bottom-hole setting.[3] It is felt that this choice should be made before starting the well because of its influence on drilling procedure, casing programs, plans for special drilling-in equipment, and effect on contract well cost. This is indicated as a joint problem of the production engineer who must produce the well and rework it when necessary, and the reservoir engineer who has the best information on formation characteristics, such as distribution of permeability and porosity. The bottom-hole settings are indicated as divided into two general classes, "set through" and "set on top," with numerous subdivisions or types under each class. The points in favor of each class are shown in Figure 2.

Selecting Hole Size. The problem of selecting hole size is indicated as a matter for joint decision by the producing, reservoir, and drilling personnel, as it involves factors concerning all. Having reached this decision, drilling operations must begin to "deliver" a completion meeting these specifications. As indicated in the next bracket, drilling personnel is charged with a decision on items which are indicated by classification numbers. These individual classifications are discussed later.

Study of these factors results in a well completion plan and cost estimate that must be submitted to management for approval. As indicated,

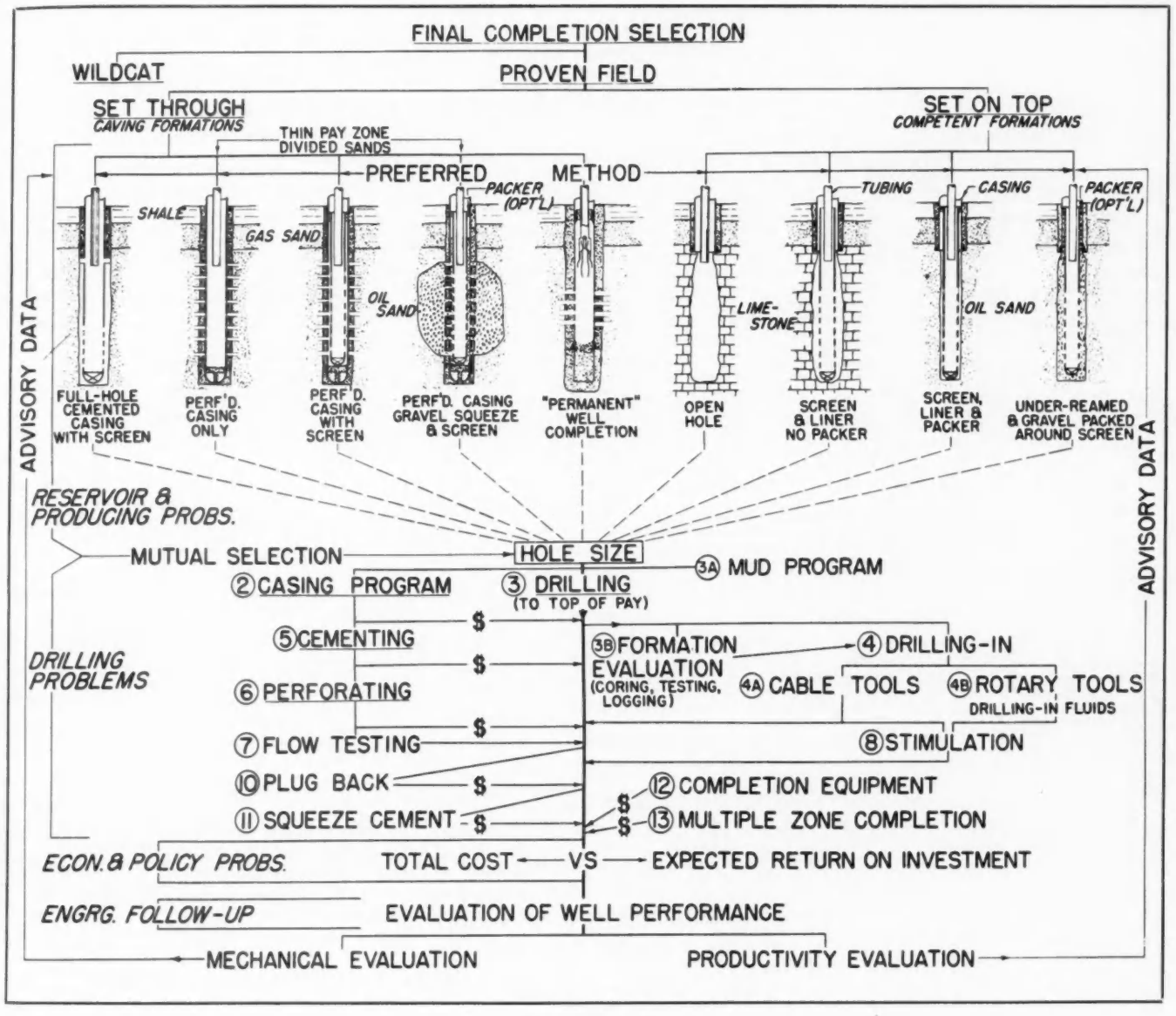

FIGURE 1

this plan is weighted from a standpoint of cost vs. expected return and is approved or modified. After final approval, the well is drilled and completed according to the plan, with such operating modifications as may be expedient during the process.

If completed as a commercial producer, an engineering follow-up is indicated by the next bracket. This work is carried out by two groups: mechanical engineering to check the performance of the surface and subsurface mechanical equipment chosen for the completion, and reservoir engineering to check the productive performance of the well on the basis of reservoir information, pressure build-up tests, etc. This phase is a process of continuous observation of equipment and well performance; and the information, as indicated by the arrows, is fed back for selection of the type of completion to be used on subsequent wells in the field. Thus, the cycle of a continuous process of well completion selection is completed.

After developing the master chart as a plan of operation, it became apparent that the detailed analysis of problems indicated on the chart would require two types of engineering effort. In view of this, the committee divided into two groups, one for consideration of mechanical problems and one for development of a system of productivity evaluation. The latter is essentially a reservoir engineering function.

Types of Bottom-Hole Settings. The choice between "set through" and "set on top" classes of completions, as indicated in Figure 2, rests largely on formation conditions. The practice of setting casing through the producing zone is indicated for caving formations, thin producing zones where gas cap or water table requires careful segregation, alternate shale and sand stringers, and for multiple zone work.

Open-hole settings are indicated where competent formation prevails, zones of poor vertical permeability are not likely to render proper drainage by perforations, where nitro shooting may be required, and at places where formation cleaning agents can more readily be used in an open hole.

Conditions favoring the use of specific types of either open-hole or set-through completions are indicated.

Continued on Next Page

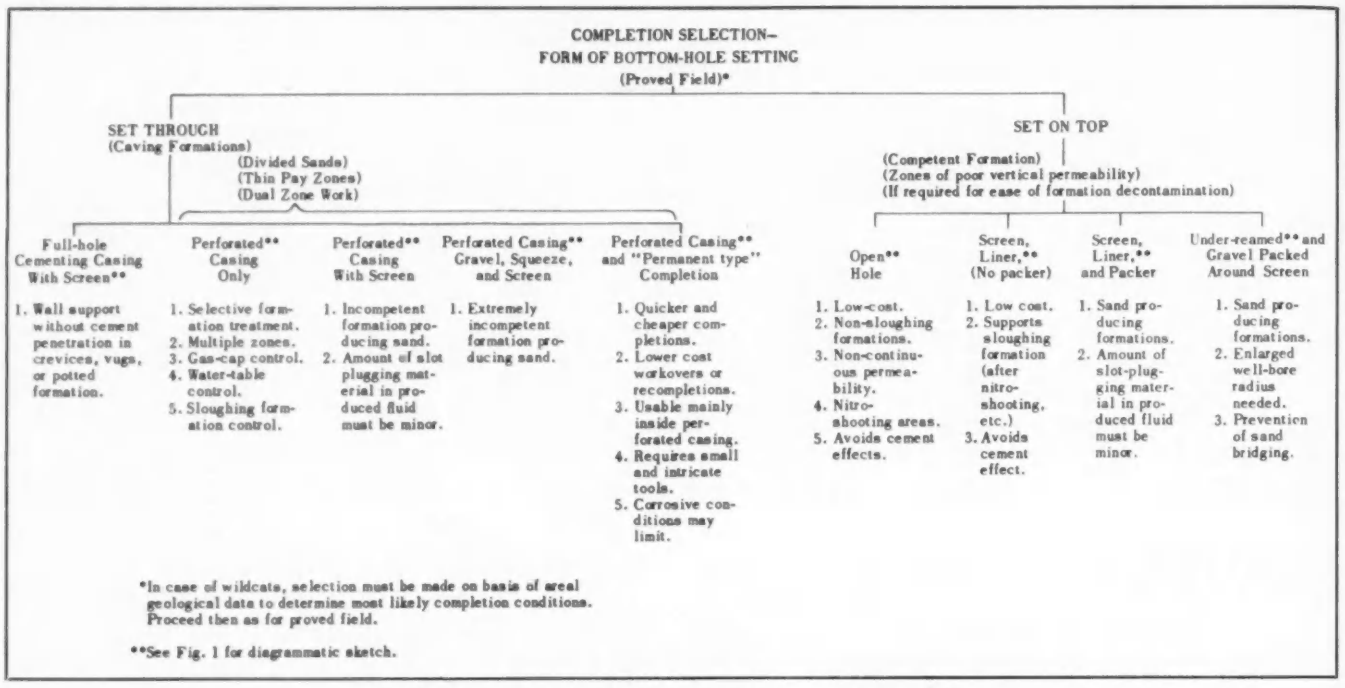
COMPLETION SELECTION–
FORM OF BOTTOM-HOLE SETTING
(Proved Field)*
SET THROUGH
(Caving Formations)
(Divided Sands)
(Thin Pay Zones)
(Dual Zone Work)
SET ON TOP
(Competent Formation)
(Zones of poor vertical permeability)
(If required for ease of formation decontamination)
Full-hole Cementing Casing With Screen**
1. Wall support without cement penetration in crevices, vugs, or potted formation.
Perforated** Casing Only
1. Selective formation treatment.
2. Multiple zones.
3. Gas-cap control.
4. Water-table control.
5. Sloughing formation control.
Perforated** Casing With Screen
1. Incompetent formation producing sand.
2. Amount of slot plugging material in produced fluid must be minor.
Perforated Casing** Gravel, Squeeze, and Screen
1. Extremely incompetent formation producing sand.
Perforated Casing** and "Permanent type" Completion
1. Quicker and cheaper completions.
2. Lower cost workovers or recompletions.
3. Usable mainly inside perforated casing.
4. Requires small and intricate tools.
5. Corrosive conditions may limit.
Open** Hole
1. Low-cost.
2. Non-sloughing formations.
3. Non-continuous permeability.
4. Nitroshooting areas.
5. Avoids cement effects.
Screen, Liner,** (No packer)
1. Low cost.
2. Supports sloughing formation (after nitroshooting, etc.)
3. Avoids cement effect.
Screen, Liner,** and Packer
1. Sand producing formations.
2. Amount of slot-plugging material in produced fluid must be minor.
Under-reamed** and Gravel Packed Around Screen
1. Sand producing formations.
2. Enlarged well-bore radius needed.
3. Prevention of sand bridging.
*In case of wildcats, selection must be made on basis of areal geological data to determine most likely completion conditions. Proceed then as for proved field.
**See Fig. 1 for diagrammatic sketch.

Fig. 2—Factors involved in the selection of type of completion.

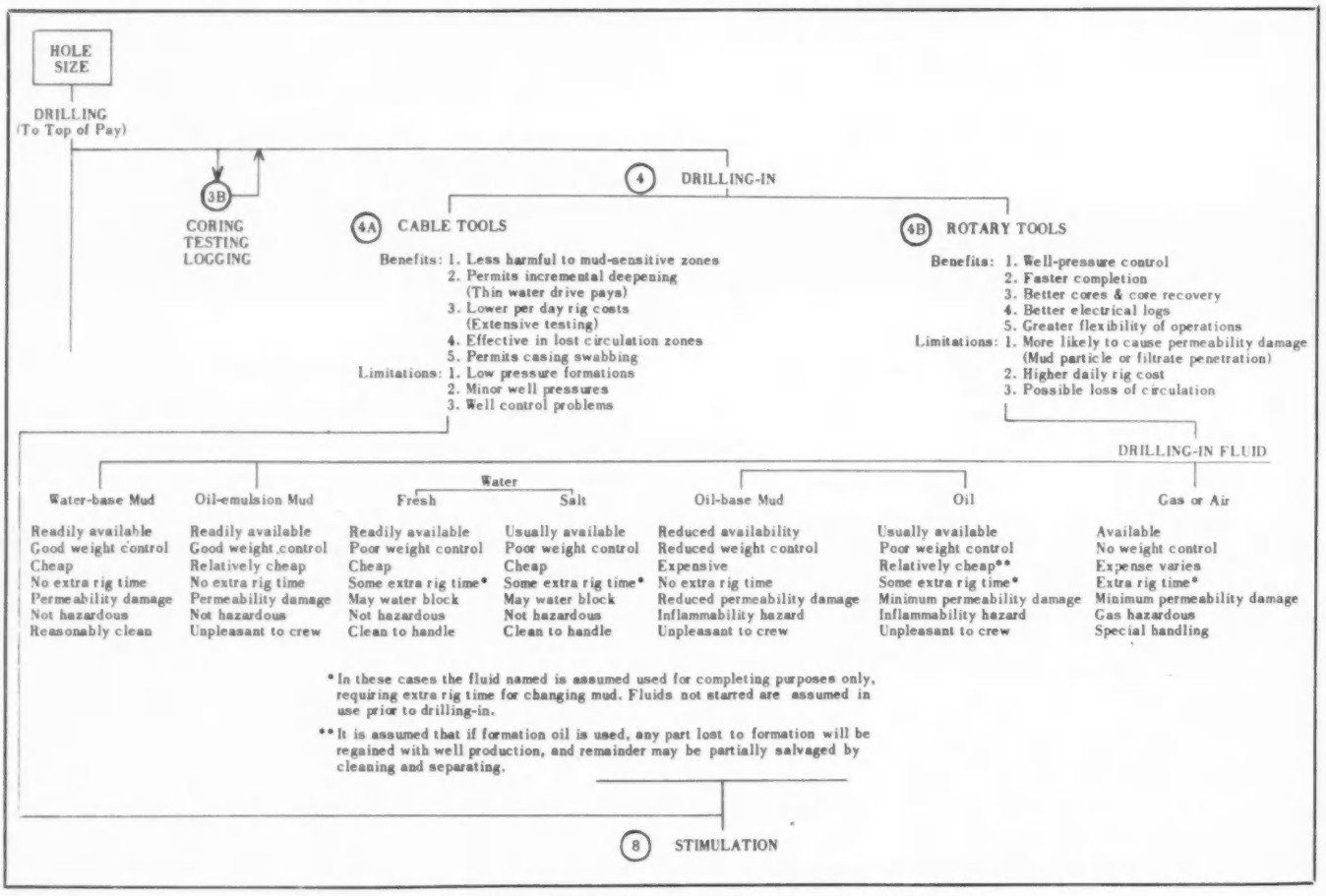

Fig. 3—Drilling-in considerations that must be carefully evaluated.

Consideration of Individual Phases of Completion Work . . .

Figure 3 is representative of the type of analysis given each phase of the completion process indicated on the master chart. Problem 4, Drilling-in, presents the choice of two general methods: cable tool (4A), or rotary (4B). The merits and limitations of each procedure are listed. If rotary drilling-in is chosen, the choice of suitable drilling-in fluid is required, and again the merits and limitations of the several alternate choices are set forth.

Since preparation of the chart as

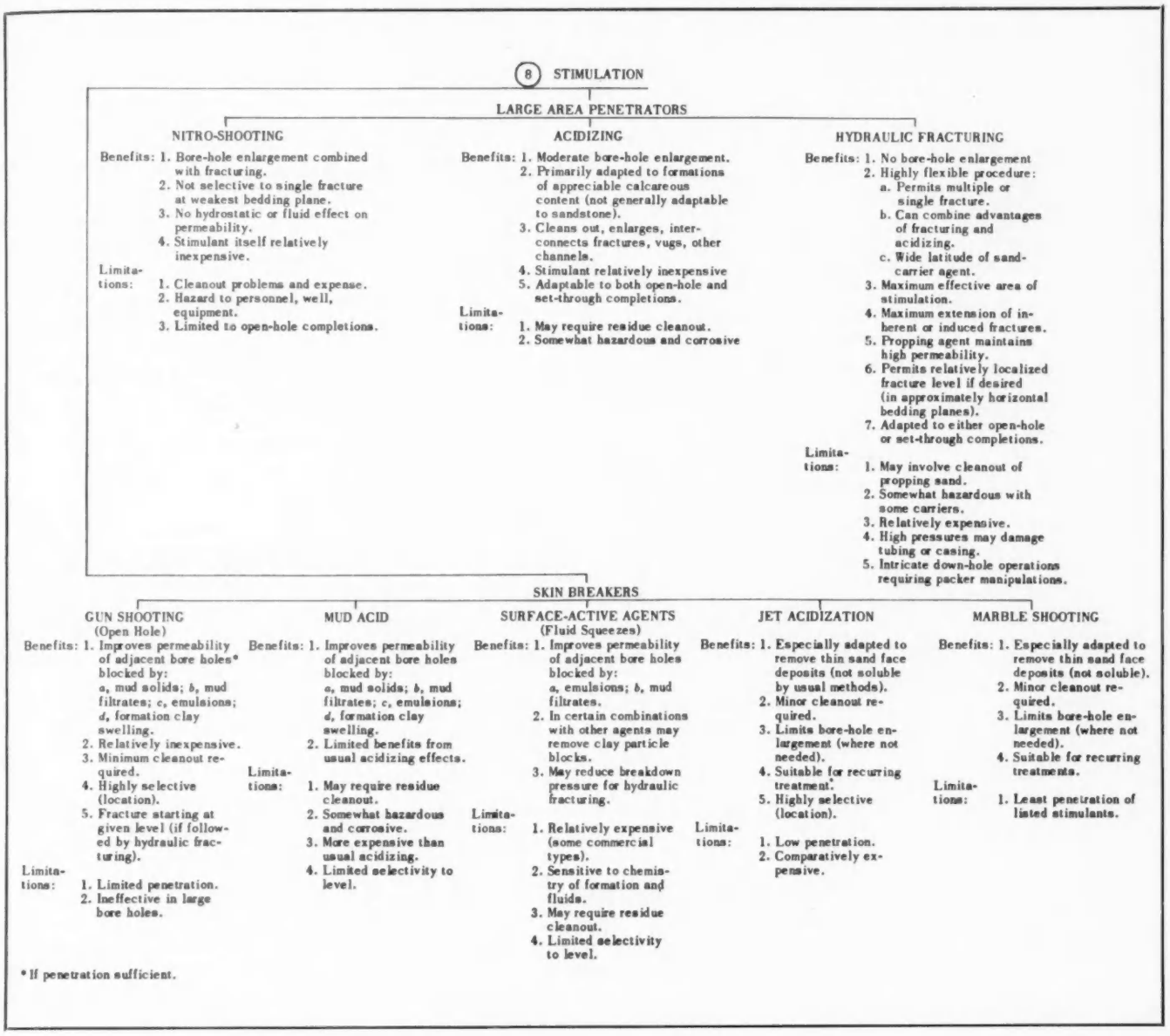
8 STIMULATION
LARGE AREA PENETRATORS
NITRO-SHOOTING
Benefits: 1. Bore-hole enlargement combined with fracturing.
2. Not selective to single fracture at weakest bedding plane.
3. No hydrostatic or fluid effect on permeability.
4. Stimulant itself relatively inexpensive.
Limitations: 1. Cleanout problems and expense.
2. Hazard to personnel, well, equipment.
3. Limited to open-hole completions.
ACIDIZING
Benefits: 1. Moderate bore-hole enlargement.
2. Primarily adapted to formations of appreciable calcareous content (not generally adaptable to sandstone).
3. Cleans out, enlarges, interconnects fractures, vugs, other channels.
4. Stimulant relatively inexpensive
5. Adaptable to both open-hole and set-through completions.
Limitations: 1. May require residue cleanout.
2. Somewhat hazardous and corrosive
HYDRAULIC FRACTURING
Benefits: 1. No bore-hole enlargement
2. Highly flexible procedure:
a. Permits multiple or single fracture.
b. Can combine advantages of fracturing and acidizing.
c. Wide latitude of sand-carrier agent.
3. Maximum effective area of stimulation.
4. Maximum extension of inherent or induced fractures.
5. Propping agent maintains high permeability.
6. Permits relatively localized fracture level if desired (in approximately horizontal bedding planes).
7. Adapted to either open-hole or set-through completions.
Limitations: 1. May involve cleanout of propping sand.
2. Somewhat hazardous with some carriers.
3. Relatively expensive.
4. High pressures may damage tubing or casing.
5. Intricate down-hole operations requiring packer manipulations.
SKIN BREAKERS
GUN SHOOTING (Open Hole)
Benefits: 1. Improves permeability of adjacent bore holes* blocked by: a, mud solids; b, mud filtrates; c, emulsions; d, formation clay swelling.
2. Relatively inexpensive.
3. Minimum cleanout required.
4. Highly selective (location).
5. Fracture starting at given level (if followed by hydraulic fracturing).
Limitations: 1. Limited penetration.
2. Ineffective in large bore holes.
MUD ACID
Benefits: 1. Improves permeability of adjacent bore holes blocked by: a, mud solids; b, mud filtrates; c, emulsions; d, formation clay swelling.
2. Limited benefits from usual acidizing effects.
Limitations: 1. May require residue cleanout.
2. Somewhat hazardous and corrosive.
3. More expensive than usual acidizing.
4. Limited selectivity to level.
SURFACE-ACTIVE AGENTS (Fluid Squeezes)
Benefits: 1. Improves permeability of adjacent bore holes blocked by: a, emulsions; b, mud filtrates.
2. In certain combinations with other agents may remove clay particle blocks.
3. May reduce breakdown pressure for hydraulic fracturing.
Limitations: 1. Relatively expensive (some commercial types).
2. Sensitive to chemistry of formation and fluids.
3. May require residue cleanout.
4. Limited selectivity to level.
JET ACIDIZATION
Benefits: 1. Especially adapted to remove thin sand face deposits (not soluble by usual methods).
2. Minor cleanout required.
3. Limits bore-hole enlargement (where not needed).
4. Suitable for recurring treatment.
5. Highly selective (location).
Limitations: 1. Low penetration.
2. Comparatively expensive.
MARBLE SHOOTING
Benefits: 1. Especially adapted to remove thin sand face deposits (not soluble).
2. Minor cleanout required.
3. Limits bore-hole enlargement (where not needed).
4. Suitable for recurring treatments.
Limitations: 1. Least penetration of listed stimulants.
* If penetration sufficient.

Fig. 4—Factors to consider in selecting the type of stimulation technique.

shown here, further attention has been given to subclassification of the drilling-in fluids, particularly water-base and oil-emulsion muds. Results of this additional work will be available in the final form of this chart when and if published in an API practice manual. Following drilling-in by either method, stimulation of production may be required, and this is indicated on the master chart as Problem 8. Figure 4 divides stimulating methods into "skin breakers," whose effects are localized to a small area adjacent to the bore hole, and "large area penetrators," whose effects extend into the reservoir some distance from the bore hole. Again, benefits and limitations are listed for each method.

Formation Evaluation. On the master chart, Figure 1, Problem 3B, is indicated as an analysis of the formation evaluation methods generally available. These are divided into coring, formation flow testing (open hole), and instrument logging. Flow testing by perforating, squeezing, and reperforating at various levels is indicated as Problem 7, later in the operation. The open-hole testing processes are indicated as tied into drilling into the formation by necessity on the chart, but this timing does not necessarily precede or coincide with drilling-in except in the case of coring. The time relation with drilling-in is varied and cannot readily be indicated. The detailed chart on "Formation Evaluation" was not completed in time for publication.

Perforating. A breakdown of the subject of gun perforating, which is Problem 6 on the master chart is shown in Figure 5. It is noted that the first choice concerns methods, whether to use jets or bullets. Any one or some combination of the factors listed here may dictate the choice for a particular well completion problem at hand. Once the method is selected, the user should properly consider the "Optimum Density of Perforations" and the "Portion of Pay Zone Perforated." In turn, these considerations may have a bearing on the choice of method to be employed. The remaining choice is the fluid in the hole during the perforating opera-

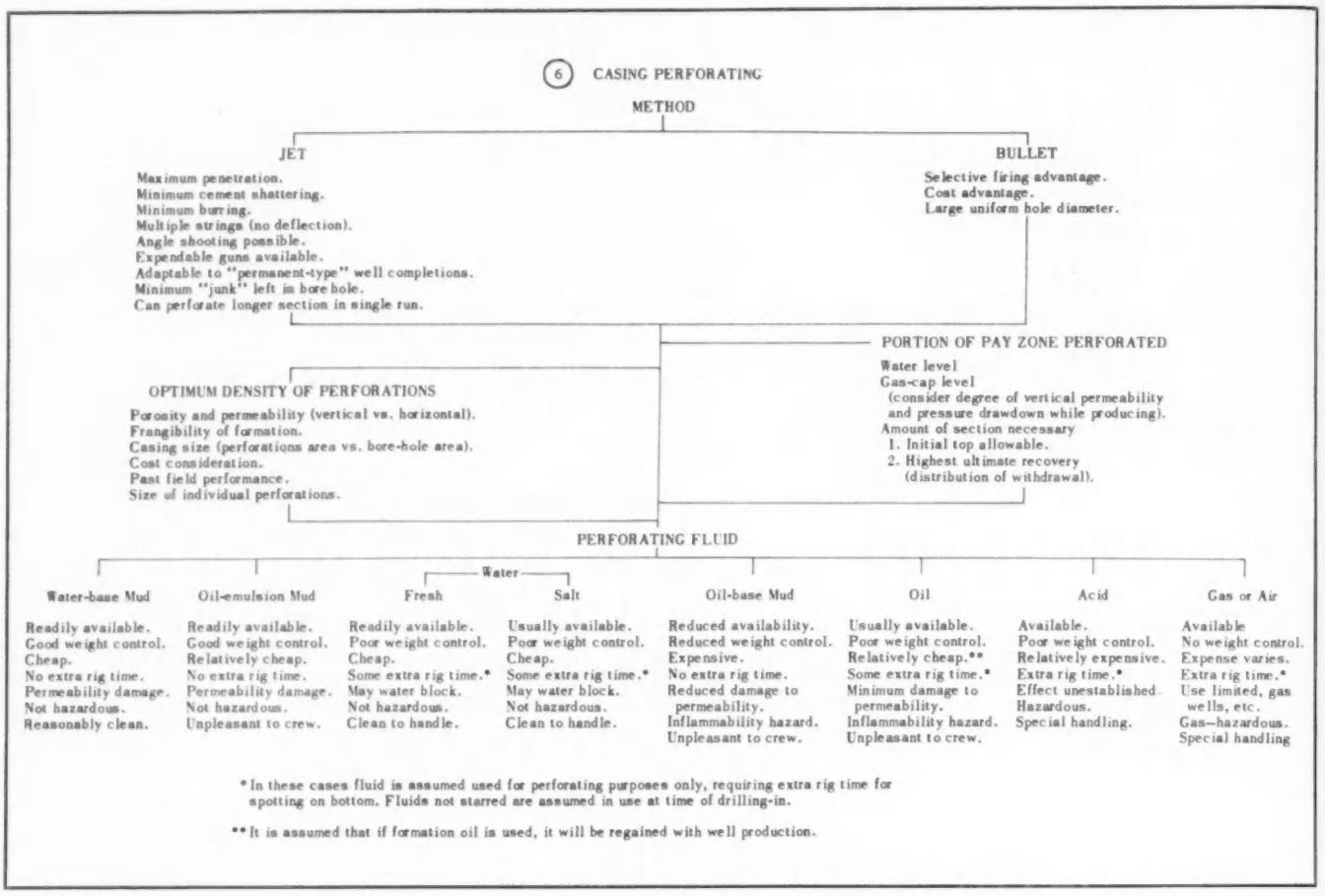

Fig. 5—Important considerations in selecting a casing perforating program.

tion. More and more attention is being paid to this factor, particularly as regards initial productivity.

Cementing. Cementing, plugback, and squeeze cementing are covered in Figures 6, 7 and 8 on the same basis of charting benefits and limitations of each. The first eight figures represent all work completed by the Well Mechanics Group at the time of publication. It should be pointed out that in all such charts these items were discussed thoroughly and the points listed were the result of a composite opinion of the group. Wording was carefully selected and was revised several times in the process of discussing each one.

Controversial points were omitted or modified to an acceptable statement. Any statement of benefits or limitations that might directly advertise or detract from any commercially advertised process was carefully avoided, requiring general group classification of such processes.

Evaluation of well performance . . .

Referring again to the master chart, it is noted that following the factor of "Economic and Policy Problems" (Management) is that of "Engineering Follow-up," which consists of an evaluation of well performance. The entire consideration will not be complete until results are accurately evaluated to determine efficiency of the final selection made and followed. As indicated on the master chart, this evaluation would consist of two phases, mechanical evaluation and productivity evaluation.

Mechanical evaluation consists of observation of the surface and subsurface well equipment during the producing life of the well. This would comprise records such as service life of equipment on a time and maintenance cost basis, corrosion on a weight loss per year basis, etc. For example, any new technique such as the permanent-type well completion would naturally involve maintenance of records as to life, serviceability, etc., of the rather specialized equipment used. This is especially true when used in a new location where the technique has not been previously subjected to certain types of corrosion, floating sand, etc. As indicated on the master chart, such records serve as continuous advisory data in the selection of subseqent completion equipment.

The Subcommittee for Well Completion Evaluation was set up as a portion of the Study Committee on Completion Practices for the purpose of studying existing or proposed methods currently available for determining whether the flow capacity of the well has been damaged or improved in the immediate vicinity of the well bore. From this study, the subcommittee is to agree upon and to propose to the industry a generally acceptable "yardstick."

Performance data from a well after completion will be used to place a value on the effectiveness of the completion practice. "Damaged" or "improved" as used here refers not only to permeability in the natural formation adjacent to the well, but includes such mechanical impediments as in-

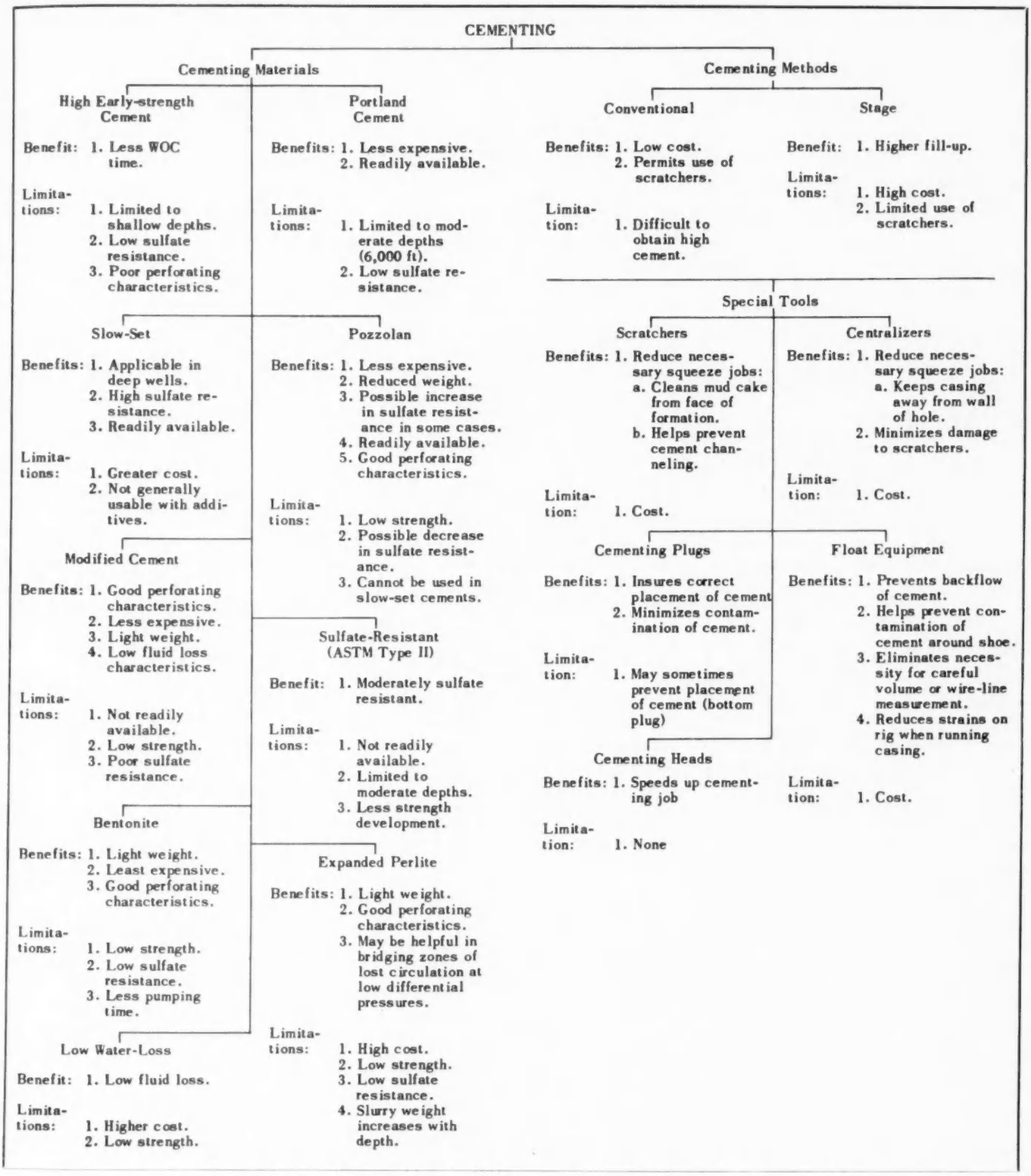
CEMENTING
Cementing Materials
High Early-strength Cement
Benefit: 1. Less WOC time.
Limitations: 1. Limited to shallow depths. 2. Low sulfate resistance. 3. Poor perforating characteristics.
Portland Cement
Benefits: 1. Less expensive. 2. Readily available.
Limitations: 1. Limited to moderate depths (6,000 ft). 2. Low sulfate resistance.
Slow-Set
Benefits: 1. Applicable in deep wells. 2. High sulfate resistance. 3. Readily available.
Limitations: 1. Greater cost. 2. Not generally usable with additives.
Pozzolan
Benefits: 1. Less expensive. 2. Reduced weight. 3. Possible increase in sulfate resistance in some cases. 4. Readily available. 5. Good perforating characteristics.
Limitations: 1. Low strength. 2. Possible decrease in sulfate resistance. 3. Cannot be used in slow-set cements.
Modified Cement
Benefits: 1. Good perforating characteristics. 2. Less expensive. 3. Light weight. 4. Low fluid loss characteristics.
Limitations: 1. Not readily available. 2. Low strength. 3. Poor sulfate resistance.
Sulfate-Resistant (ASTM Type II)
Benefit: 1. Moderately sulfate resistant.
Limitations: 1. Not readily available. 2. Limited to moderate depths. 3. Less strength development.
Bentonite
Benefits: 1. Light weight. 2. Least expensive. 3. Good perforating characteristics.
Limitations: 1. Low strength. 2. Low sulfate resistance. 3. Less pumping time.
Expanded Perlite
Benefits: 1. Light weight. 2. Good perforating characteristics. 3. May be helpful in bridging zones of lost circulation at low differential pressures.
Limitations: 1. High cost. 2. Low strength. 3. Low sulfate resistance. 4. Slurry weight increases with depth.
Low Water-Loss
Benefit: 1. Low fluid loss.
Limitations: 1. Higher cost. 2. Low strength.
Cementing Methods
Conventional
Benefits: 1. Low cost. 2. Permits use of scratchers.
Limitation: 1. Difficult to obtain high cement.
Stage
Benefit: 1. Higher fill-up.
Limitations: 1. High cost. 2. Limited use of scratchers.
Special Tools
Scratchers
Benefits: 1. Reduce necessary squeeze jobs: a. Cleans mud cake from face of formation. b. Helps prevent cement channeling.
Limitation: 1. Cost.
Centralizers
Benefits: 1. Reduce necessary squeeze jobs: a. Keeps casing away from wall of hole. 2. Minimizes damage to scratchers.
Limitation: 1. Cost.
Cementing Plugs
Benefits: 1. Insures correct placement of cement 2. Minimizes contamination of cement.
Limitation: 1. May sometimes prevent placement of cement (bottom plug)
Float Equipment
Benefits: 1. Prevents backflow of cement. 2. Helps prevent contamination of cement around shoe. 3. Eliminates necessity for careful volume or wire-line measurement. 4. Reduces strains on rig when running casing.
Limitation: 1. Cost.
Cementing Heads
Benefits: 1. Speeds up cementing job
Limitation: 1. None

Fig. 6—Prior to cementing casing, these factors should be carefully evaluated.

sufficient or improperly placed perforations, partially plugged perforations, partially plugged well screen, or mechanical improvements such as artificially induced fractures, acidized formation, and other effects in the immediate vicinity of the bore hole.

The application of the results of this work of the subcommittee is indicated in Figure 1 by the bracket at the lower portion of the chart entitled "Productivity Evaluation" and the flow of advisory data from this point to selection of subsequent completion methods. Importance of this work is much greater than the small space devoted to it on the master chart would indicate. The same is true of the magnitude of the problem assumed by those who have agreed to work on it.

The Subcommittee on Well Completion Evaluation met at regular intervals over the past year and investigated the various techniques for measuring the effect of well completion practices of the productivity of wells. Although studies of productivity indexes may be used to evaluate this effect, the subcommittee decided that the pressure build-up method of test-

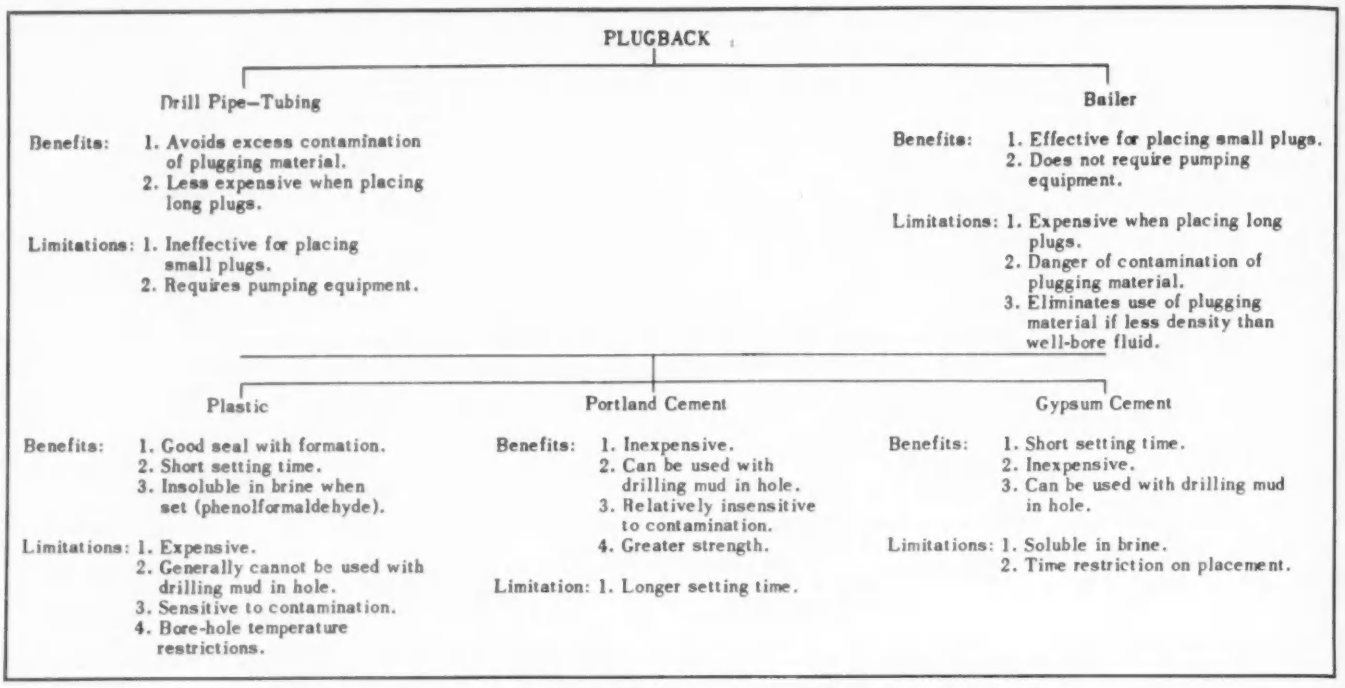
PLUGBACK
Drill Pipe–Tubing
Benefits: 1. Avoids excess contamination of plugging material. 2. Less expensive when placing long plugs.
Limitations: 1. Ineffective for placing small plugs. 2. Requires pumping equipment.
Bailer
Benefits: 1. Effective for placing small plugs. 2. Does not require pumping equipment.
Limitations: 1. Expensive when placing long plugs. 2. Danger of contamination of plugging material. 3. Eliminates use of plugging material if less density than well-bore fluid.
Plastic
Benefits: 1. Good seal with formation. 2. Short setting time. 3. Insoluble in brine when set (phenolformaldehyde).
Limitations: 1. Expensive. 2. Generally cannot be used with drilling mud in hole. 3. Sensitive to contamination. 4. Bore-hole temperature restrictions.
Portland Cement
Benefits: 1. Inexpensive. 2. Can be used with drilling mud in hole. 3. Relatively insensitive to contamination. 4. Greater strength.
Limitation: 1. Longer setting time.
Gypsum Cement
Benefits: 1. Short setting time. 2. Inexpensive. 3. Can be used with drilling mud in hole.
Limitations: 1. Soluble in brine. 2. Time restriction on placement.

Fig. 7—If a plugback is necessary, here are some items that must be considered.

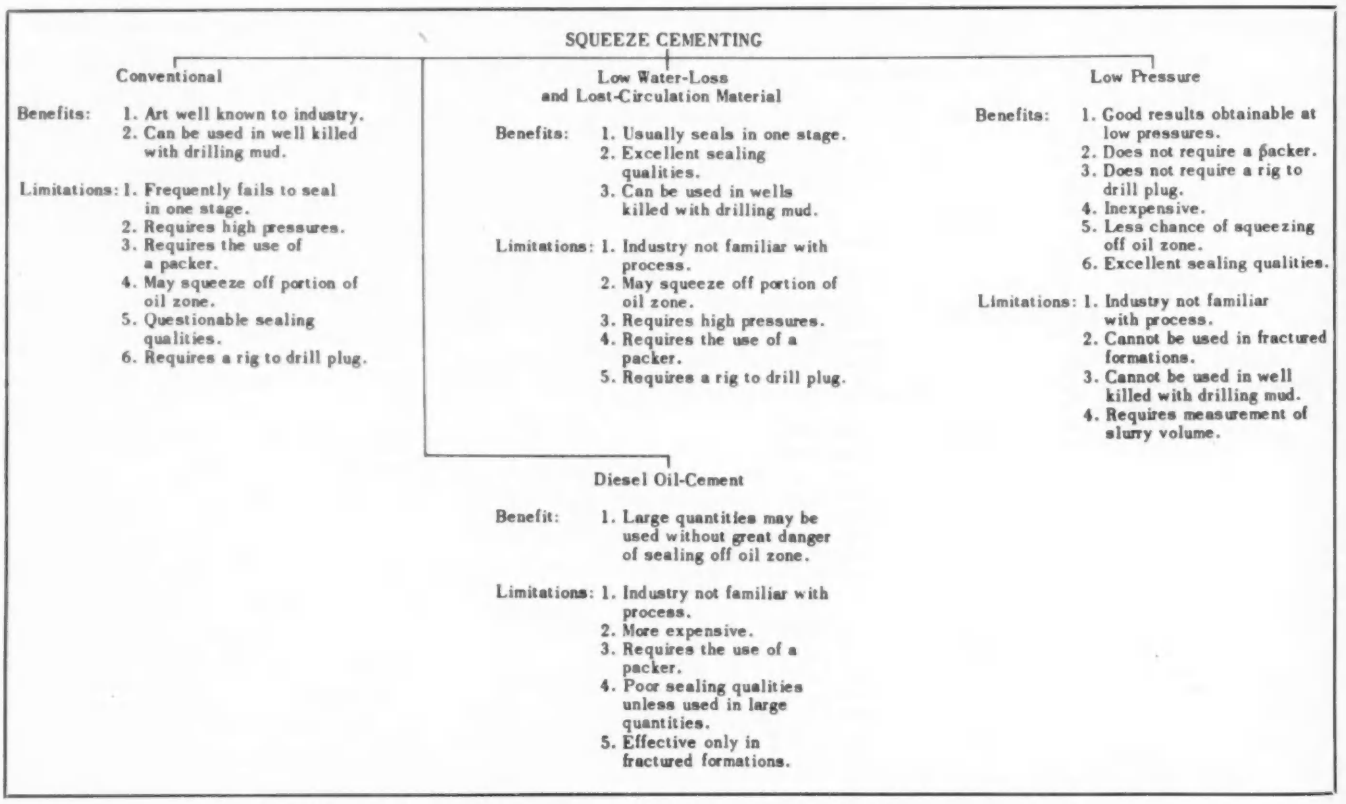
SQUEEZE CEMENTING
Conventional
Benefits: 1. Art well known to industry. 2. Can be used in well killed with drilling mud.
Limitations: 1. Frequently fails to seal in one stage. 2. Requires high pressures. 3. Requires the use of a packer. 4. May squeeze off portion of oil zone. 5. Questionable sealing qualities. 6. Requires a rig to drill plug.
Low Water-Loss and Lost-Circulation Material
Benefits: 1. Usually seals in one stage. 2. Excellent sealing qualities. 3. Can be used in wells killed with drilling mud.
Limitations: 1. Industry not familiar with process. 2. May squeeze off portion of oil zone. 3. Requires high pressures. 4. Requires the use of a packer. 5. Requires a rig to drill plug.
Low Pressure
Benefits: 1. Good results obtainable at low pressures. 2. Does not require a packer. 3. Does not require a rig to drill plug. 4. Inexpensive. 5. Less chance of squeezing off oil zone. 6. Excellent sealing qualities.
Limitations: 1. Industry not familiar with process. 2. Cannot be used in fractured formations. 3. Cannot be used in well killed with drilling mud. 4. Requires measurement of slurry volume.
Diesel Oil-Cement
Benefit: 1. Large quantities may be used without great danger of sealing off oil zone.
Limitations: 1. Industry not familiar with process. 2. More expensive. 3. Requires the use of a packer. 4. Poor sealing qualities unless used in large quantities. 5. Effective only in fractured formations.

Fig. 8—Consideration to be given either of three methods of squeeze cementing.

ing wells yields the most reliable information. After reaching this decision, the subcommittee investigated methods of interpreting pressure build-up data that have been published by van Everdingen[1] of Shell Oil Company, and Miller, Dyes and Hutchinson[2] of Atlantic Refining Company.

Pressure Build-Up Method. The ideal pressure build-up method of testing a well consists of flowing a well at a steady rate of oil production until an essentially steady-state pressure distribution exists about the well in the reservoir. This ideal steady-state condition is not always attained in practice. Sub-surface pressures are measured near the productive horizon in the well bore while the well is flowing and continuously after the well is shut-in for a period of 24 to 72 hours. Resulting pressures are plotted as a function of the logarithm of time or the logarithm of a time function which includes the past production history of the well.

If either method of plotting gives a

build-up curve that has a straight line portion, the permeability of the reservoir can be calculated from the slope of the straight line. This calculated permeability does not include the permeability of that part of the reservoir immediately around the well bore which may have damaged or improved permeability as a result of the completion of the well and which may have a considerable effect on the well's production performance. The skin effect may be calculated from the slope of the straight line, physical properties of the reservoir oil and reservoir rock, and the measured flowing pressure and may be expressed on a pressure drop basis; or a damage ratio may be calculated by comparing the permeability of the reservoir removed from the well bore (undisturbed formation) with an over-all permeability from a productivity index.*

*Damage Factor $= \frac{Kh}{K_2 h}$, where:

K = reservoir permeability determined from productivity index.
K_2 = permeability in area away from well determined from pressure build-up curve.
(Terms as defined in reference 2.)

Determination of a value for the "skin" or a "damage factor" does not define the nature of the skin as to whether it is a filtrate block or some other mechanical damage or improvement effects previously mentioned. It merely expresses the relationship of the flowing capacity of the well as compared to that of a clean, unblocked hole of the same diameter in completely undisturbed natural state formation. It points out that something in the completion process has hindered or helped the flow capacity of the well a defined amount, but leaves it to a mechanical study of the completion process to determine the cause. The skin value may be negative (better than normal) if fractures, for example, provide flow surface in excess of the normal hole bore face, as indicated in Figure 9.

At the present time, the Subcommittee on Well Completion Evaluation is preparing standard methods for conducting build-up tests and for evaluating the effect of well completion practices on the productivity of wells which the subcommittee hopes will be acceptable to the API. This agreement as to methods of evaluation has been made possible by the study of the "Shell" and "Atlantic" methods and by the conclusion developed by the subcommittee that both methods are essentially indentical. In addition, the subcommittee is collecting pressure build-up and well completion data from companies cooperating with the project, to develop, if possible, guide lines for determining the best well completion methods with well productivity as the principal criterion.

The time required for the completion of these projects by the subcommittee probably will be about a year. It is hoped that members of the evaluation group will then be able to present the results of their work in a paper.

Present work just the beginning . . .

The work to date is only partially complete and is subject to considerable addition and revision. Suggestions are welcomed by the committee from all who are interested.

It is felt that, on the basis of the committee work to date, a charted method of considering the factors involved in choosing well completion procedure is workable. This charted method when completed will readily lend itself to publication as a portion of a practice manual. Such a manual will be a convenient reference to those responsible for well completions and will serve as a guard against overlooking points important to their choice.

After such a manual is published it will be subject to constant revision to keep up with continual discoveries and practice changes in the industry, probably requiring continuing work of a study group.

Work on devising a generally acceptable method of evaluating effectiveness of well completions has made good progress. It now appears that a generally acceptable method can be worked out on the basis of the two major methods previously proposed, which seem to be fundamentally in agreement.

ACKNOWLEDGEMENT

The authors wish to express their appreciation to R. C. Clark, head of the Subcommittee on Mechanics of Well Completion and R. V. Smith, head of the Subcommittee on Well Completion Evaluation, and to the members of their committees. Their effort has made the publication of this paper possible. Acknowledgement also is made to the Stanolind Oil and Gas Company and The Carter Oil Company for permission to the authors to engage in this work and publish this paper. It is pointed out that opinions expressed in this paper are those of an API working group and do not necessarily reflect the viewpoint of the authors' companies. Appreciation is expressed to Prof. A. W. W. Walker of the University of Tulsa for providing space for weekly study meetings of the Completion Mechanics Subcommittee.

REFERENCES

[1] Van Everdingen, A. F. and Hurst W., The Application of the Laplace Transformation to Flow Problems in Reservoirs, *Jour, Petrol. Technol.*, vol. 1, Dec. 1949, pp. 305-325.

Van Everdingen, A. F., The Skin Effect and Its Influence on the Productive Capacity of a Well, *Jour. Petrol. Technol.*, vol. 5, May 1953, pp. 135-138.

[2] Miller, C. C., Dyes, A. B., and Hutchinson, C. A. Jr., The Estimation of Permeability and Reservoir Pressure from Bottom-Hole Pressure Build-up Characteristics, *Jour. Petrol. Technol.*, vol. 2, Apr. 1950, pp. 91-104.

[3] DeGolyer, E., Elements of the Petroleum Industry, A.I.M.E. 1940 (The type of diagrammatic sketch shown in Figure 44 of this publication was utilized in compiling Figure 1 of this paper.)

—The End

Coming in the Gulf Coast Issue next month . . .

. . . the latest information on Tide Water Associated Oil Company's exceptionally high-pressure gas-condensate field near Houma, La. . . . where the flowing tubing pressures exceeded 9000 pounds per square inch. This article will highlight the Production Section in June. Watch for it!

With well costs going up, more attention is being given dual zone completions. The basic methods are described and illustrated with the advantages and disadvantages pointed out in perhaps one of the most comprehensive reports ever assembled on . . .

Dual Completion Equipment and Practices

By MARSHALL C. TURNER, Phillips Petroleum Company, Bartlesville, Okla.

DUAL ZONE COMPLETIONS can afford considerable savings in reduced development costs in comparison to drilling separate wells to each zone, thereby permitting the development of oil reserves in some marginal zones that otherwise would not be produced. If two oil zones can be depleted efficiently by means of a dual-zone well, or if a marginal zone can be economically incorporated in a producing well, dual-zone completions become attractive. The feasibility of installing production equipment into a single string of casing to produce desired fluid rates from each zone, after cessation of natural flow, is a factor in the justification for a dual completion. The fluid lifting methods and rates of production required will determine the number and sizes of tubing strings to be run, which in turn determine the size of casing to be employed. Therefore, production equipment requirements for the entire life of a dual-zone well should be anticipated prior to the establishment of a drilling program.

Mention of dual completions was made in the technical literature of the late 1930's, although the practice did not achieve wide application at that time. During the war, restrictions imposed by regulatory bodies governing the number of wells permitted, together with the necessity of conserving steel, were factors which promoted the development of dual completion practices. During recent years the rate of such completions has been accelerated. This is principally the result of mounting development costs, plus the necessity for finding an economic means of recovering oil and gas present in zones of small reserves. There is no reason to foresee a downward trend in this program, for as drilling gets deeper and more expensive, zones which cannot support a reasonable return for the drilling of a single zone completion may become economical if they can be included in dual completions.

Advantages of dual-zone wells are based principally upon those economic factors related to development costs. These may be summarized as follows:

- Two marginal zones, neither of which would support single well development, may be combined to provide a profitable dual completion.
- Otherwise uneconomic zones may be opened for production in an existing well.
- Maximum production is achieved at the earliest possible date through decreased development time.
- Offset obligations on marginal zones may be fulfilled.
- Considerable savings in steel and reduced development costs are obtainable in comparison to drilling separate wells.

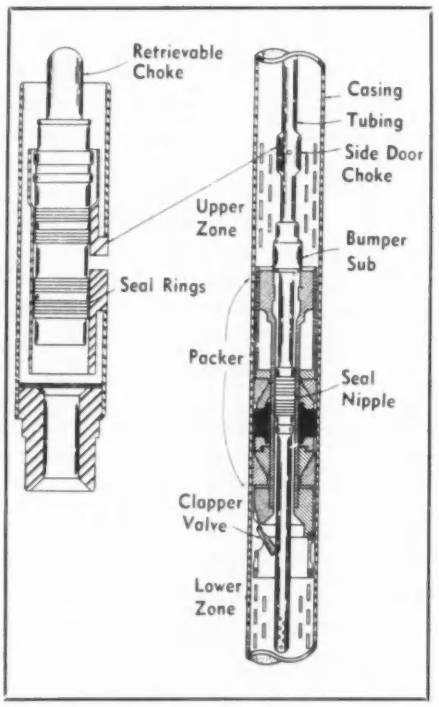

Fig. 1—Type of packer which may be run on wire line or on pipe is shown in 1-A (right). Side door choke 1-B (left) may be run in tubing string above packer for increased flexibility.

Some operators have completed dual-zone wells with the objective of reverting to a single completion at the time one zone ceases to flow. Thus a marginal stringer which would not otherwise be produced, and for which artificial lifting equipment cannot be justified, is opened to production for a period of time with resultant increase in oil recovery from the property. There are also instances of dual completions on leases having no offset wells where one zone is temporarily abandoned when it ceases to flow. It is returned to production as a single completion at the time the other zone is depleted and can be plugged.

It is a relatively simple technique to produce dual-zone oil wells wherein both zones are flowing. In time, formation pressures decline, natural flow ceases, and it becomes necessary to lift fluid from one or both zones by

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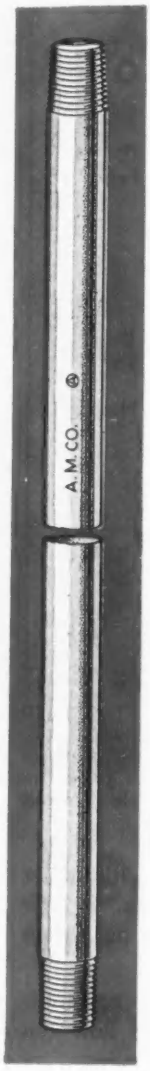

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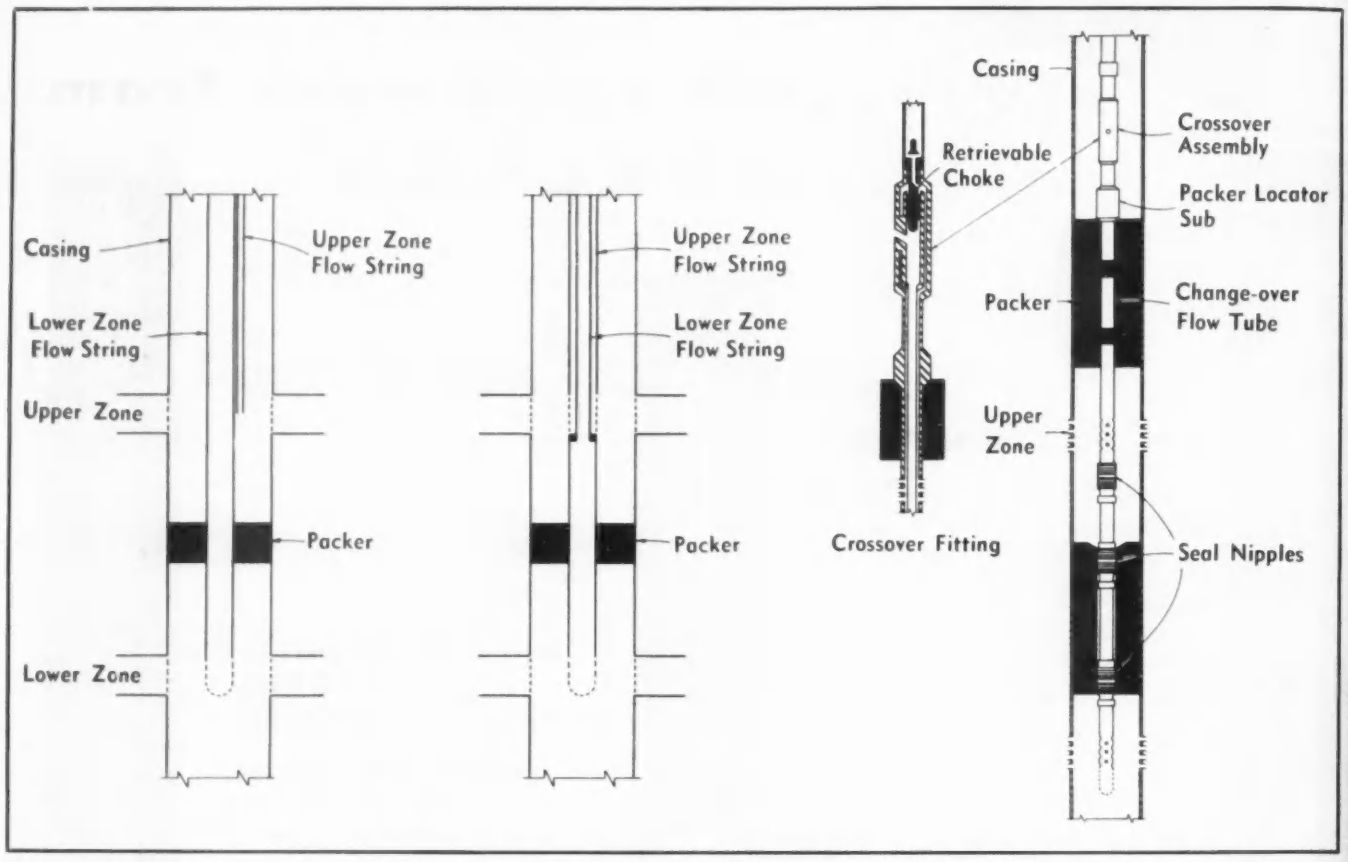

Fig. 2—Single packer isolation of zones, utilizing parallel tubing strings.

Fig. 3—Single packer installation with concentric tubing strings.

Fig. 4—Two packer installation which provides high degree of flexibility by the addition of selective flow courses placed in tubing string. Crossover nipple controls flow.

placing adequate lifting equipment within the confines of a single string of casing. While we are unable to apply to dual-zone wells all of the production methods which are applicable to single-zone completions, the range of production techniques applicable to dual completions has been substantially enlarged in recent years by the development of new tools and equipment. Dual-zone completions do not have indiscriminate application; they offer considerable savings in development costs if producing and reservoir characteristics indicate that the desired production rates can be efficiently produced after cessation of natural flow. The degree of success in artificially lifting fluid from a dual completion will be to a large extent dependent upon the forethought and planning relative to designing the casing and completion program to fit the anticipated production requirements.

Methods of Zone Isolation. There are three primary means of isolating producing zones. These may be summarized as follows:

- A single packer is installed between zones. Either single, parallel, or concentric tubing strings may be used.
- Two packers are installed, one above each zone. As above, single, parallel, or concentric tubing strings may be used.
- A parallel tubing string packer is used in conjunction with either of above two methods. In this case only parallel tubing strings are used.

Figures 1 through 7 are schematic illustrations of packer and flow systems which may be used.

Single packer installations . . .

Figure 1A illustrates a type of packer commonly used which may be set either by wire line or run on pipe. The tubing string is equipped with a sealing nipple which provides the seal between zones when inserted into the packer. The packer may be equipped with a bottom clapper valve which closes when the tubing is raised; thus each zone may be swabbed-in separately by raising or lowering the tubing. A latching device is available for locking the tubing to the top of the packer should this be desirable where high differential pressures may exist. In this installation, the upper zone must flow through the annulus and the lower zone through the tubing.

Figure 1B shows details of a side-door choke which can be placed in the tubing string for increased flexibility of operations. By running the proper choke on a wire line the side port may either be closed or opened; thus drilling fluid may be circulated out and both zones brought in together. The upper zone may be shut-in and the lower zones brought in separately. Each zone may be fractured or acidized separately, the lower zone through the tubing, and the upper zone through the casing.

Figures 2 and 3 indicate parallel and concentric flow systems feasible with the single packer. These installations offer the possibility of longer

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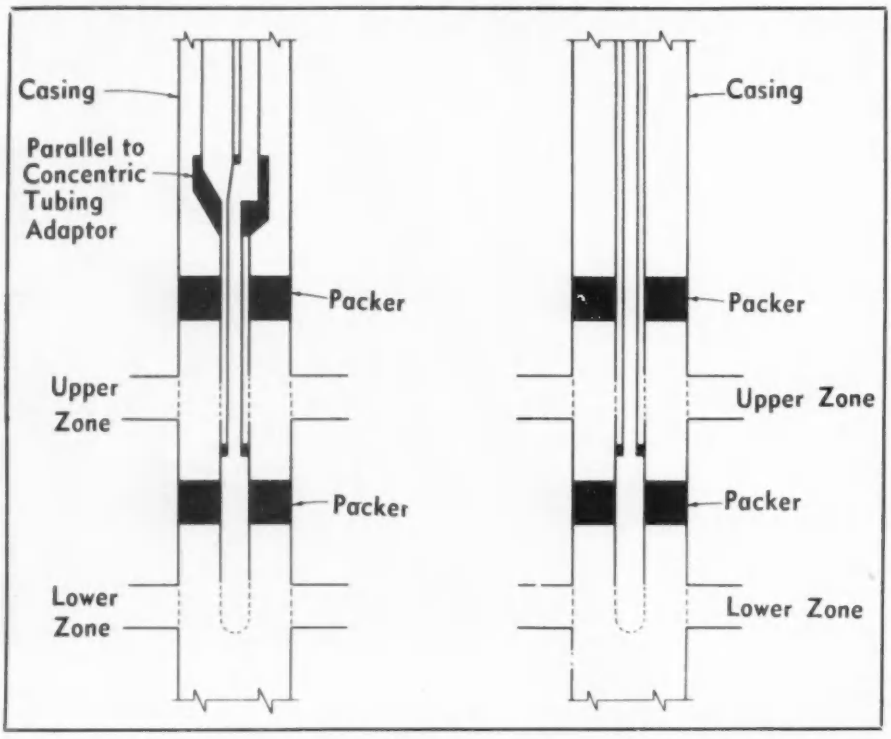


Fig. 5—Zones isolated by setting packers over each zone and utilizing parallel tubing strings from upper packer to surface.

Fig. 6—Two packer isolation with concentric tubing strings to maintain separate production.

flowing life for the upper zone by eliminating the necessity for flow through the relatively larger area of the casing annulus. In Figure 2, parallel strings are clamped together and run simultaneously. Concentric strings afford some advantage in that the inside string may be pulled separately, leaving the larger tubing in place. These installations are easily converted to straight gas-lift systems, particularly for the upper zone. Either the casing annulus or one of the tubing strings may be used for gas supply.

Two packer installations . . .

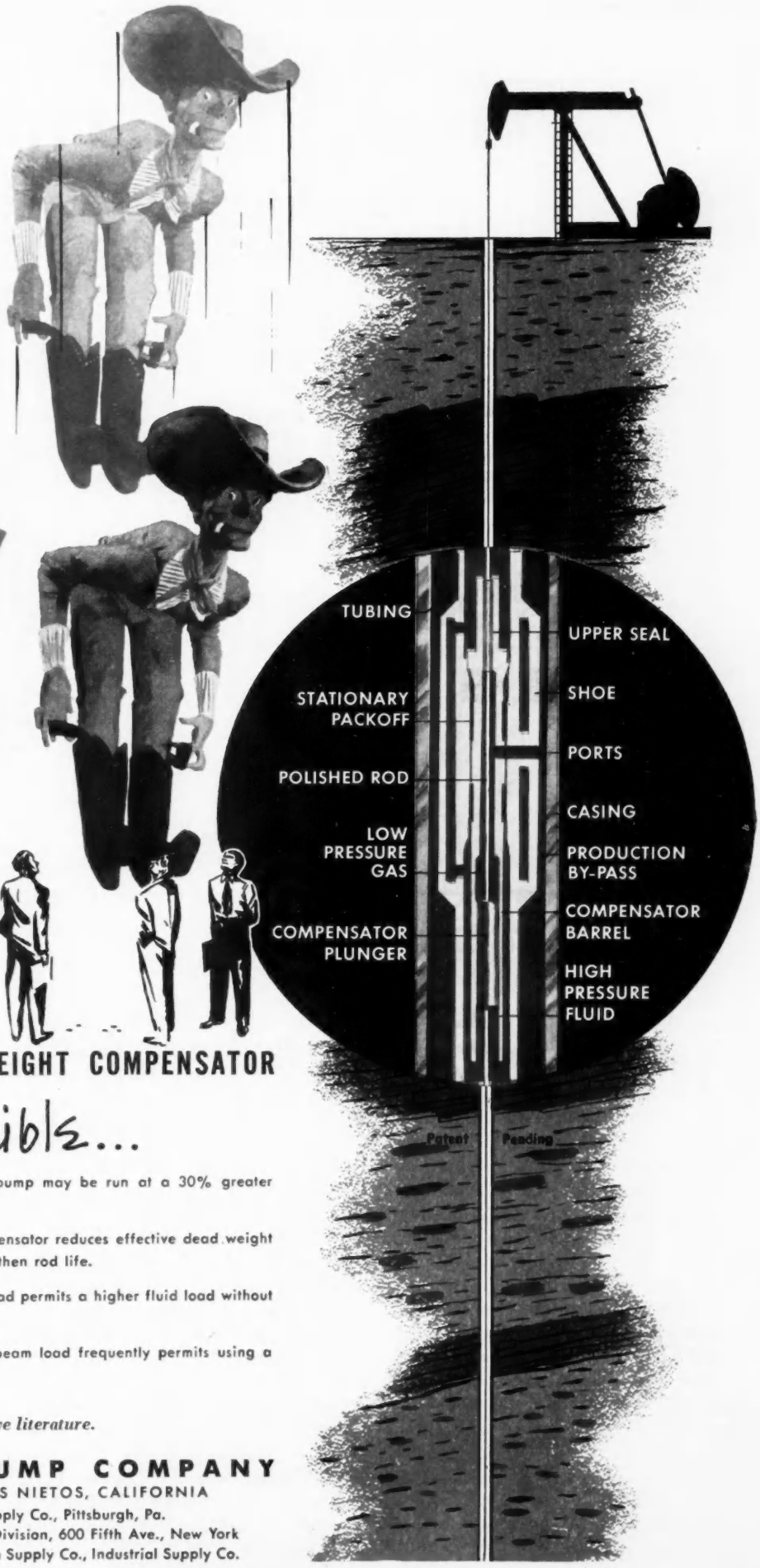
Figure 4 illustrates the installation of one packer above each zone. Both packers may be permanently set, or in some instances, a retrievable type packer may be used above the upper zone. This system provides a high degree of flexibility with the addition of selective flow courses installed in the tubing string. Concentric tubing extensions project below the top packer to keep the zones separated. Chokes can be inserted into the crossover assembly by wire line to allow separate flow of each zone through either the tubing or casing annulus. These flow reversals can be made at any time without killing the well. In this illustration the lower zone flows through the center tubing extension and is diverted into the casing at the crossover nipple. The upper zone flows through the tubing extension annulus and into the tubing string. Either zone can be shut-in. Either zone also may be fractured or acidized through the tubing, and each zone can be swabbed-in separately through the tubing. If one zone stops flowing, pumping equipment can be installed in the tubing to pump fluid within the limitation imposed by lack of gas-oil separation.

Figures 5 and 6 show parallel and concentric tubing string installations using single packers and seal nipples above each zone. Since the casing annulus is not required as a flow course, these systems provide the advantage that mud may be left in the casing should formation pressures make this desirable. Here again, the parallel strings are run simultaneously, while in Figure 6 the inside tubing string may be retrieved separately. Both systems may provide longer flowing life since neither zone is required to flow in the annulus. Use of the two concentric strings with two packers has not received wide aplication because of lack of flexibility in handling the upper zone. It cannot be swabbed-in separately unless the smaller tubing is pulled and the lower zone shut-in. Bottom-hole upper zone pressure tests are difficult to obtain. The zones are commingled when the inside string is pulled.

A dual completion with parallel tubing strings and a dual string packer is shown in Figure 7. This packer is a retrievable type, run on the tubing. The dual-string packer is shown added to a completion employing a retainer packer above each zone. The dual-string packer may be used with a single packer completion, replacing the upper retainer packer. Both zones are handled separately at all times, and either zone can be swabbed or killed without interfering with production from the other. This system lends itself for conversion to a number of artificial lifting methods.

Artificial Lift. The above systems described for control of dual-zone flowing wells satisfy the requirements for operation of flowing production. As previously mentioned, to justify a dual completion it is necessary to be able to produce efficiently the desired rates from cessation of natural flow to the well's economic limit. In the production of wells by artificial lifting methods, the majority of wells will require techniques which permit maximum removal of back-pressure on the formation in order that desirable production rates will be maintained. That period in the life of a well at which time this factor becomes important depends principally upon reservoir characteristics and allowables. A well which ceases to make its allowable is immediately a candidate for an improved production method, and the simplest way of increasing fluid entry into the well is by a reduction of back-pressure on the formation while producing.

In some instances, it may be possible to gas-lift or plunger-lift dual zones for several years until one zone reaches its economic limit and the well can be reverted to a single producer. In the majority of well, these methods offer only intermediary tech-



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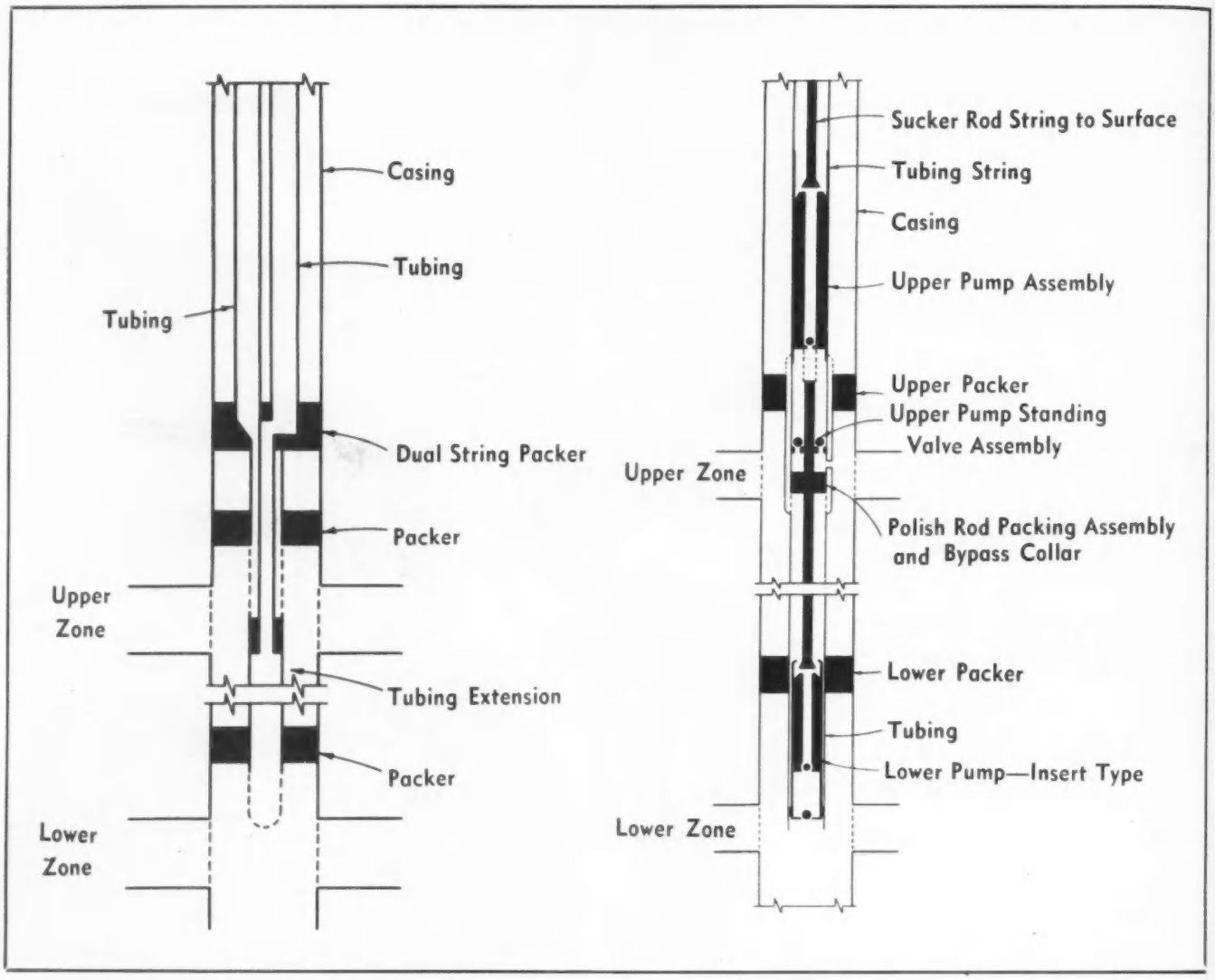

Fig. 7—Dual completion with parallel tubing strings and dual string packer.

Fig. 8—Working principles of a dual-zone pump.

niques and as formation pressures decline, greater producing drawdowns are desired.

To date, bottom-hole pumps provide the most effective means of achieving this pressure drawdown. An essential requirement of an oil pump installation is the separation of gas from the oil prior to fluid entry into the pump. These two concepts, i.e., gas-oil separation in the well bore, and bleeding of gas at the surface with resultant removal of backpressure on the well, form the fundamental requirements of an oil well pumping system. These are the requirements which are at present limiting greater use of existing dual-zone pumps.

Effective production with these pumps is limited to wells of very low gas-oil ratios since all produced gas must pass through the pump bore. Nor is it believed that the withdrawal of gas from below a packer can be achieved simply by running a small bore tubing string to the surface. The tubing will tend to load up with fluid and will not function as a gas-oil separator. The solution appears to lay in being able to pump the producing fluid level sufficiently below the packer in order to that the casing annulus becomes the separation reservoir and the small tubing then provides an escape for the gas.

For a single zone well, under the ideal situation, reservoir characteristics should be the sole determinants in establishing the production technique. Given the production and decline rates, gravity, gas-oil ratio, formation pressure, and productivity index data, it can be established whether the well should be gas-lifted, intermitted, operated with a plunger lift, or a hydraulic or rod pump installed. However, the situation is seldom ideal and choice of equipment is affected by such factors as proration schedules, existing lease facilities, cost of equipment, and competitive conditions. When, in addition, considerations are introduced relative to dual-zone completions, it is found that additional factors will affect the choice of production equipment. The fluid lifting methods to be used will determine the number and sizes of tubing strings to be run, which in turn will determine the size of casing to be used. Therefore one cannot over-emphasize the need for anticipating production equipment requirements for the entire life of a dual-zone well prior to establishment of a drilling program.

Continued on next page

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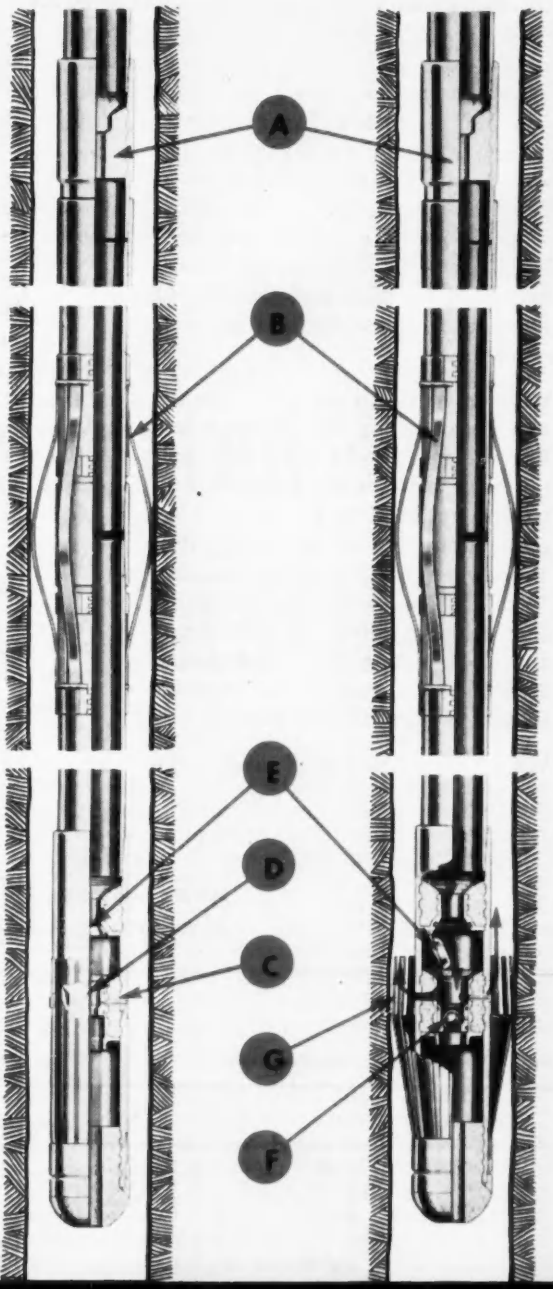

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Considerations in selecting equipment for dual wells . . .

Table 1 shows some of the considerations necessary when contemplating a dual-zone well. In this example the upper zone is to be pumped from 7300 feet, and the lower zone is a gas distillate zone which will flow to its economic limit. Various pumping methods are listed for the upper zone, together with accompanying flow courses for the lower zone. Other choices of pumping installations could be included to make the list more complete; however, those shown are representative of displacements available for the condition outlined, and will serve to illustrate the necessary considerations. Referring to Table 1 these considerations are outlined below.

- What minimum size flow course can be used for the lower zone? For the rates to be produced, will excessive back-pressure on the formation result if a 1, 1¼, or 1½-inch tubing string is used? Will the lower surface pressure resulting from the smaller tubing string affect the gas sale price? If larger than 1½-inch tubing is required, Nos. 1, 4, 7, 8, and 9 may be eliminated as possible installations.
- What will be the gas-oil ratio of the upper zone? Will it be so low as to permit efficient pump operation without gas withdrawal from below the pump? If bottom-hole gas separation is necessary, Nos. 2, 3, and 5 are eliminated. If it is believed that the upper zone can be successfully pumped from below a packer, a greater range of pump displacement is available; however, in considering pump operation without gas separation it is believed production rates should be based on pump efficiencies lower than the 70 percent indicated.
- What peak rod stress can be tolerated? Will corrosion be present so as to restrict rod loads to possibly 24,000 pounds per square inch, or can a 28,000 psi stress be allowed? This consideration will considerably affect obtainable production rates should rod pumps be employed.
- What is the maximum fluid rate to be produced from the upper zone? The rate obtainable will have to be estimated in the light of the above factors.

With answers to these questions the type of equipment indicated and the casing size required become evident. For example, if it is assumed that 200 barrels per day are required from the upper zone with gas-oil separation below the pump, and at least a 2-inch flow string is needed for the lower zone, 7-inch casing must be used. Selection of lift equipment is limited to a long stroke hydraulic pumping unit or a bottom-hole hydraulic pump.

In general, the operator who has completed a number of dual zone wells with 5½-inch casing faces serious obstacles when artificial lift is required for one or both zones. Seven-inch pipe offers the minimum internal diameter which permits installation of two 2-inch tubing strings. This advantage greatly increases the possible combinations of production equipment which may be utilized. Economic justification for 7-inch casing seems apparent for dual oil zone completions unless it is known that one zone will flow to depletion through small tubing without substantial sacrifice of production.

Experience indicates that the additional completion cost for completing a well with 7-inch pipe instead of 5½-inch will vary from approximately $5000 for a 6000-foot well to $16,000 for a 10,000-foot completion. A single well servicing job on one of these wells may exceed this difference. Dual-zone wells completed with 7⅝ or 8⅝-inch casing offer more room with which to work but the limitations are essentially the same as in 7-inch pipe.

If by reason of drilling a dual com-

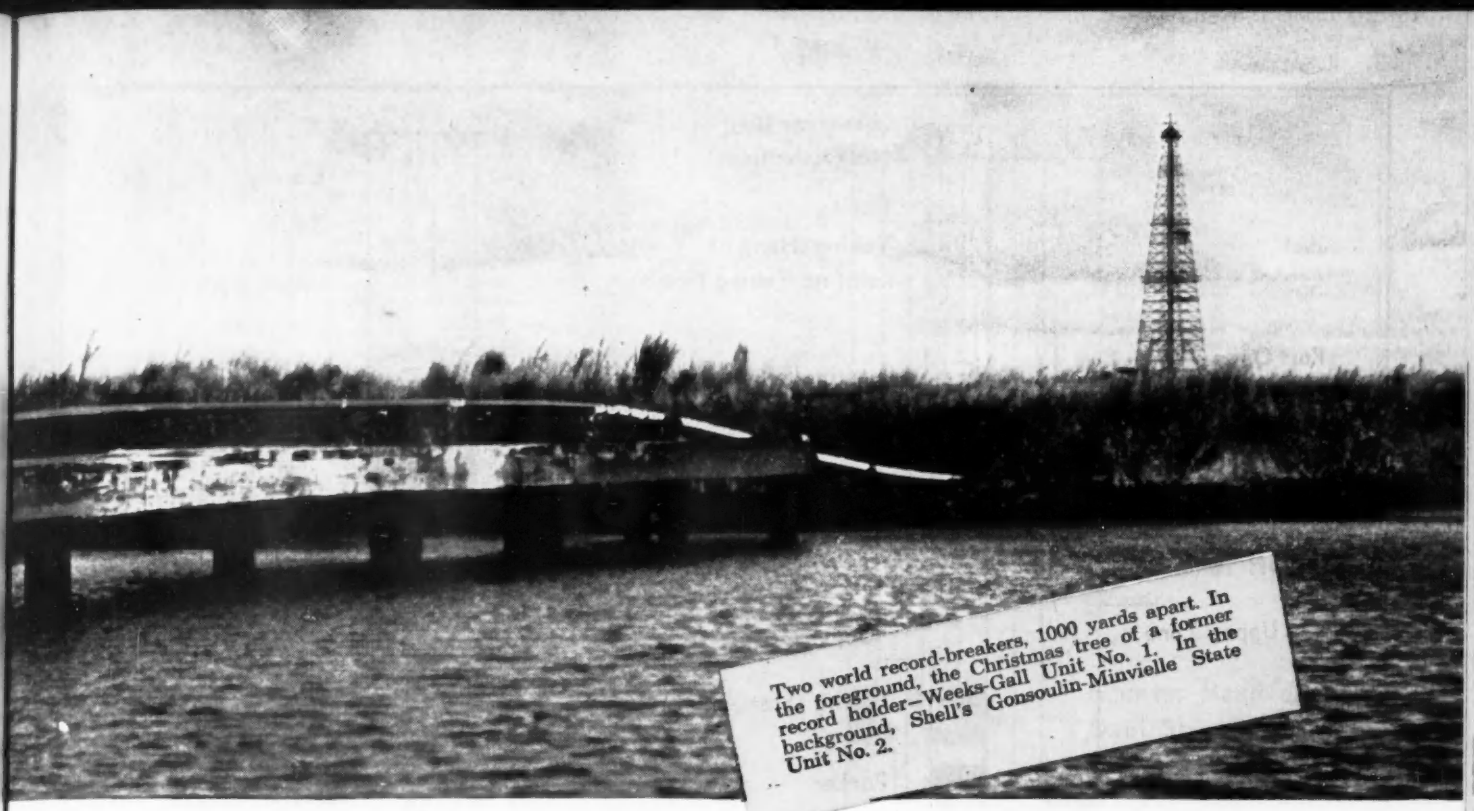
TABLE 1

Sub-Surface Production Equipment for Proposed Dual Completions

CONDITIONS: Upper zone; depth 7300′; fluid to be produced with bottom-hole pump.
Lower zone; depth 7500′; gas distillate zone will flow to economic limit.

No.	Lower Zone Flow Courses	Upper Zone Tubing	Pumping Method	Upper Zone Gas-Oil Separation in Casing Possible	Top Rod Size	Estimated Pk. Rod Stress PSI	Pump Size	Pump SPM	Estimated Maximum Production 70% PVE Bbls./Day
			FOR 5½″ (17 LB.) CASING						
1	1″ EU	2″ EU	74″ Stroke Beam	Yes	⅞″	28,000	1¼″	10	60
2	Casing	2½″ EU	120″ Stroke Beam	No	1″	28,000	1¼″	10	130
3	Casing	2½″ EU	300″ Stroke Hydraulic	No	1″	32,600	1¾″	5½	360
4	1¼″ Hyd. CS.	2″ Hyd. CS. x ¾″ EU	Conventional Hydraulic Pump 60″ Stroke	Yes	....	.....	2″ x 1½″	10	115 (250 psi. loss in ¾″ tbg.)
5	Casing	2½″ EU x 1¼″ EU	Conventional Hydraulic Pump 24″ Stroke	No	....	.....	2½″ x 1¼″	71	245
			FOR 7″ (23 LB.) CASING						
6	2″ EU	2″ EU	74″ Stroke Beam	Yes	⅞″	28,000	1¼″	10	60
7	1½″ EU	2½″ EU	300″ Stroke Hydraulic	Yes	1″	32,060	1¾″	5½	360
8	1½″ EU	2½″ EU x 1¼″ EU	Conventional Hydraulic Pump 60″ Stroke	Yes	....	.....	2½″ x 1¾″	18	270
9	1″ EU	3″ EU x 1¼″ EU	Conventional Hydraulic Pump 24″ Stroke	Yes	....	.....	3″ x 1½″	64	425

All installations feasible in 5½″ casing can be run in 7″ casing with increased annular clearance.



Two world record-breakers, 1000 yards apart. In the foreground, the Christmas tree of a former record holder—Weeks-Gall Unit No. 1. In the background, Shell's Gonsoulin-Minvielle State Unit No. 2.

# of casing were supported by BUTTRESS-THREAD CASING

IN drilling the Gonsoulin-Minvielle State Unit No. 2, at Weeks Island Field, 15 miles south of New Iberia, Louisiana, Shell Oil Company has accomplished feats believed unprecedented in the oil industry. Among them:

Set a new depth record for commercial production — 17,260 to 17,306 feet.

Drilled over 17,000 feet of hole in 90 days' time.

Cut more than 1,000 feet of hole below 14,000 feet in 30 days' time.

Drilled to 14,000 feet and 9⅝ inch casing set in only 32 days, with *no* difficulties encountered.

"No difficulties encountered" — even at the total depth of 18,568 feet.

And for good reason. The top of the 14,000 feet of 9⅝ inch casing was 4,300 feet of NATIONAL N-80 Buttress-Thread Casing — carrying the load. Engineering acumen? Careful planning? To be sure! Both revealed in the choice of the *right* material—NATIONAL SEAMLESS.

NATIONAL Buttress-Thread Casing is made to order for a job like this. It was especially developed to satisfy the petroleum industry's need for a casing joint which would support the tremendous weight of long strings of deep-well casing with safety and economy. The high tensile strength of the buttress-thread joint is due largely to the combined effect of the completely engaged runout threads and the three degree flank angle of the thread which support the weight of the casing in the well. The joint, in fact, is comparable in strength to that of the body of the pipe. The buttress-thread casing eliminates the need for upset end casing—gives greater inside clearance for the drilling bit. Moreover, it permits easy, faster coupling to power-tight position.

For further information on National Tube developments in the oil industry, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

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UNITED STATES STEEL

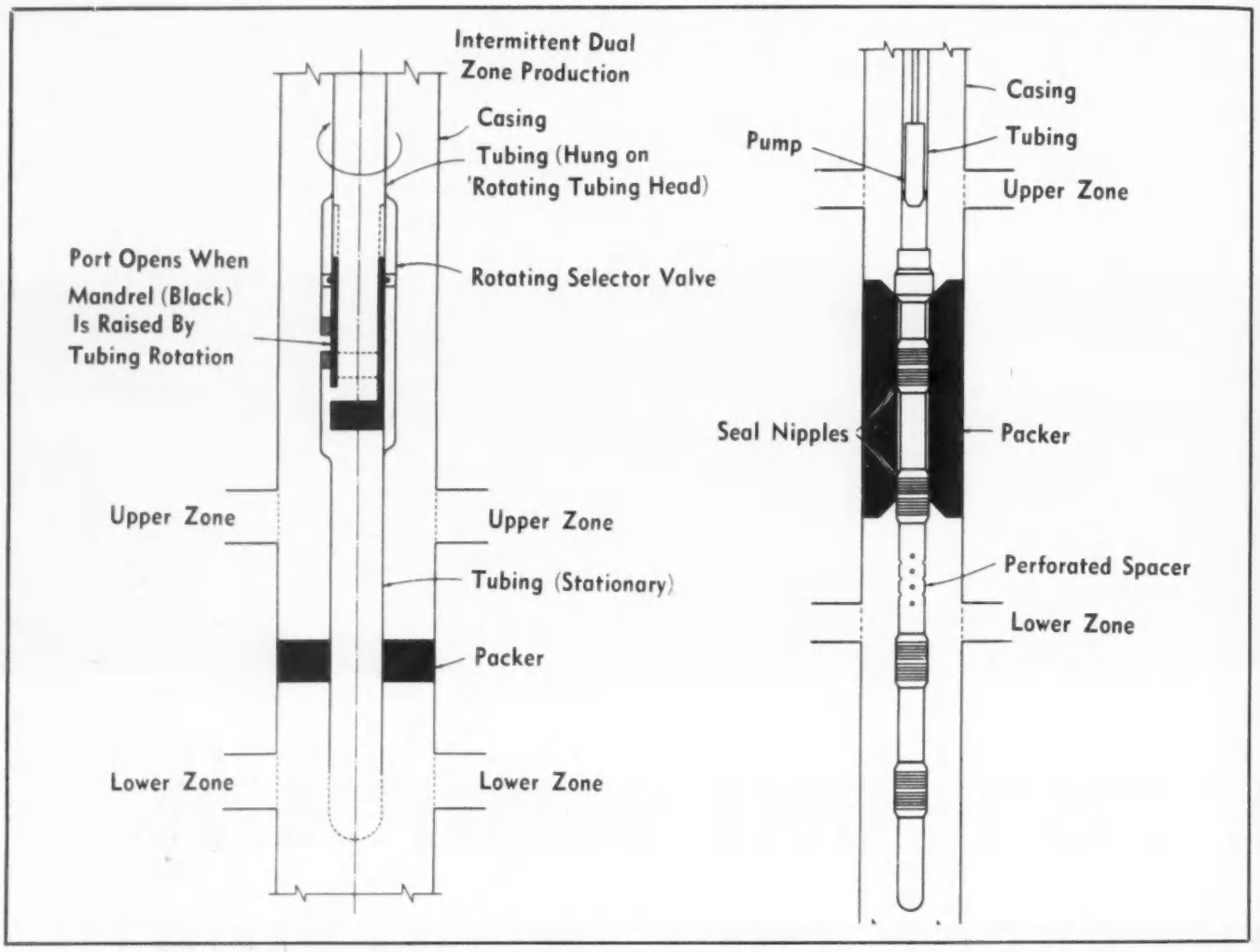


Fig. 9—Another approach to dual zone pumping that provides for gas separation in upper zone.

Fig. 10—Either zone may be pumped by raising or lowering the tubing string. Seal nipples isolate the two zones.

pletion, larger than 7-inch pipe is required in comparison to drilling twin wells with 5½ or 7-inch casing, economic advantages of dual completions diminish. Whereas, contractors will frequently drill the same hole size 8¾-inch for 5½ and 7-inch casing; 8⅝-inch pipe will usually require an 11¼-inch hole or larger and the cost differences for both drilling and material take a substantial increase.

Some basic dual well installations . . .

Adaptation of existing production equipment to provide artificial lift for dual-zone completions can cover a wide range of innovations. There are several basic installations which can be adapted to fit various requirements for producing dual completions.

First are those methods which are applicable to dual-zone wells completed with 5½-inch casing. By using parallel tubing strings or by running small diameter tubing in conjunction with the equipment described in Figures 1 through 7, various means of gas-lifting can be devised for one or both zones. Gas-lift valves can be incorporated with parallel or concentric tubing strings and the casing annulus used for gas supply. A number of such systems are in operation. The plunger-lift must not be overlooked as a means of increasing flowing life or, under proper conditions, as a method of gas-lift. The problems of applying gas-lift to dual completions are not complicated; however, the eventual and more difficult requirement will be to pump one or both zones. An installation which has become common practice is the addition of a sucker-rod or hydraulic pump to the equipment illustrated in Figure 4. A pump is seated in the tubing above the crossover assembly to pump one zone. The other zone continues to flow through the casing annulus, or is gas-lifted by means of a small diameter parallel tubing string. This is a relatively simple installation, its success will depend largely upon the extent to which the zone can be pumped without providing below pump gas-oil separation.

Dual-Zone Pumping. Working principles of a dual-zone pump are shown in Figure 8. Essential parts are the upper pump and lower pump assemblies connected together by a polish rod traveling through a packing assembly. The lower pump may be any conventional insert type which will pass through the barrel of the upper pump. The upper pump is an

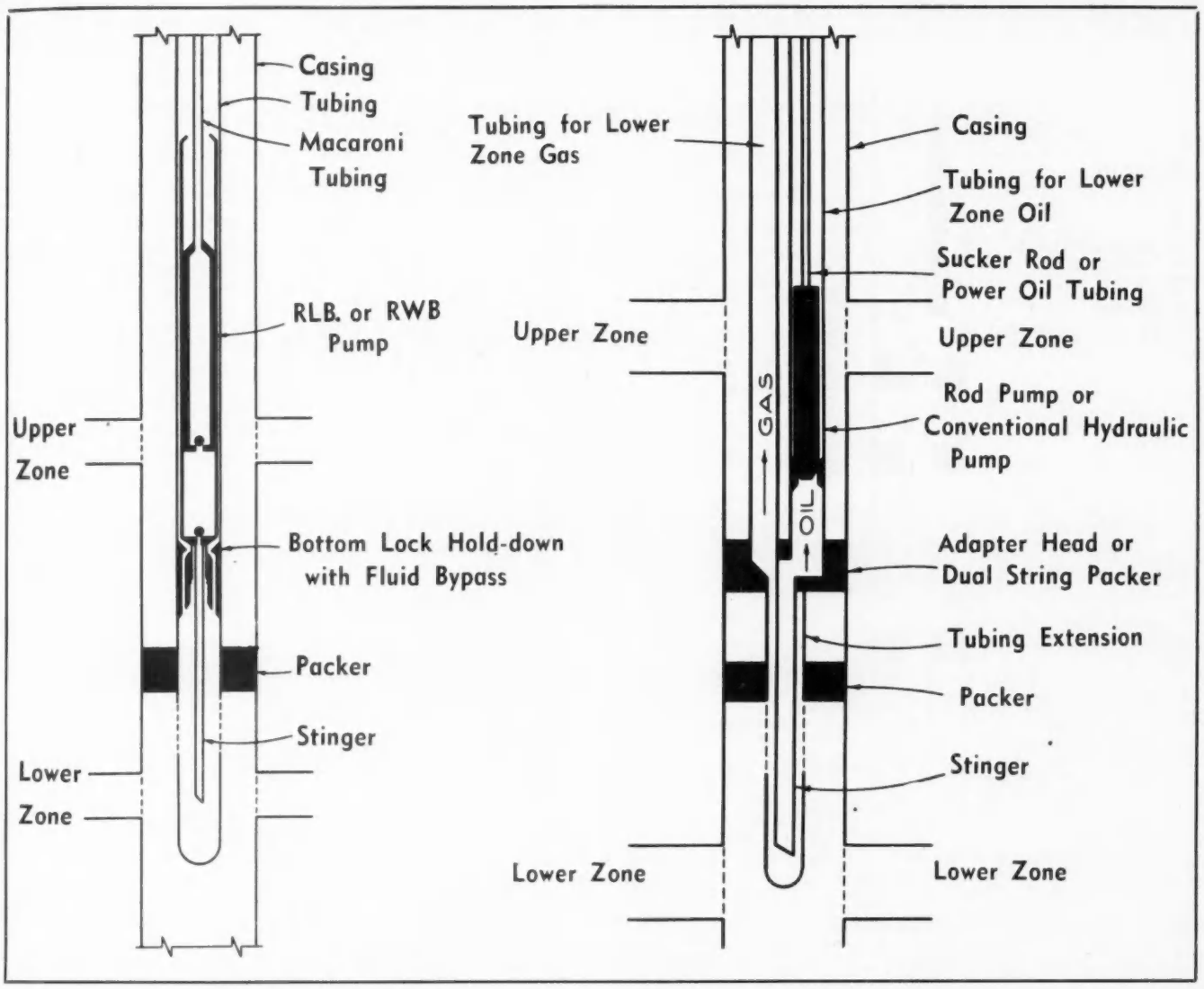


Fig. 11—In this pumping method, gas may be removed from below the pump without using casing annulus. Only the lower zone is pumped.

Fig. 12—Proposed system of pumping lower zone whereby parallel strings are used. One string conducts gas from lower zone to surface, while second string handles liquid production.

intricately designed assembly in which a polish rod is fastened to the bottom of the plunger, and the standing valve must be placed in the annular space around this rod.

The upper pump working barrel, bypass collar and packer, and lower pump seating shoe are made up on the tubing. The remaining pump equipment is run in on the rods. Fluid from the lower pump flows up the tubing, bypasses around the packoff and upper standing valve assemblies, and is discharged into the casing annulus above the top packer. The upper zone is pumped through the upper pump and fluid flow is through the tubing. Since the operating speed is the same for both pumps, displacement differences may be obtained by variations in plunger sizes.

Another approach at pumping two zones, with the addition that gas-oil separation is possible in the upper zone is shown in Figure 9. This method utilizes a rotating selector valve. It is essentially a side-door choke, operated by rotation of the tubing. With the mandrel in the upward position, the lower zone is closed off and the upper zone is pumped as a single zone well. With the mandrel in the lower position (as shown), the upper zone is shut-in and the lower zone is open to the pump. When the lower zone is being pumped, all produced gas must pass through the pump. The length of time a zone is pumped will depend upon the frequency necessary to achieve the desired average daily rate from each zone. It is not always possible to make an allowable in 15 days and the time cycle between rotations has to be shortened. Eventually production will be restricted by this system.

Figure 10 illustrates another method which is used to pump alternately two zones in wells of moderate depths. This entails raising and lowering the entire tubing string so that the perforated nipple between the seal nipples is open to one zone at a time. The use of this hookup of course requires a casing head with packoff features which will provide a seal while the tubing is raised and lowered. Some operators have installed surface hydraulic lifting equipment to facilitate raising and lowering the tubing. Here again production rates are restricted when full time pumping is necessary to produce the desired rates.

Figure 11 illustrates a method of pumping which has been applied to

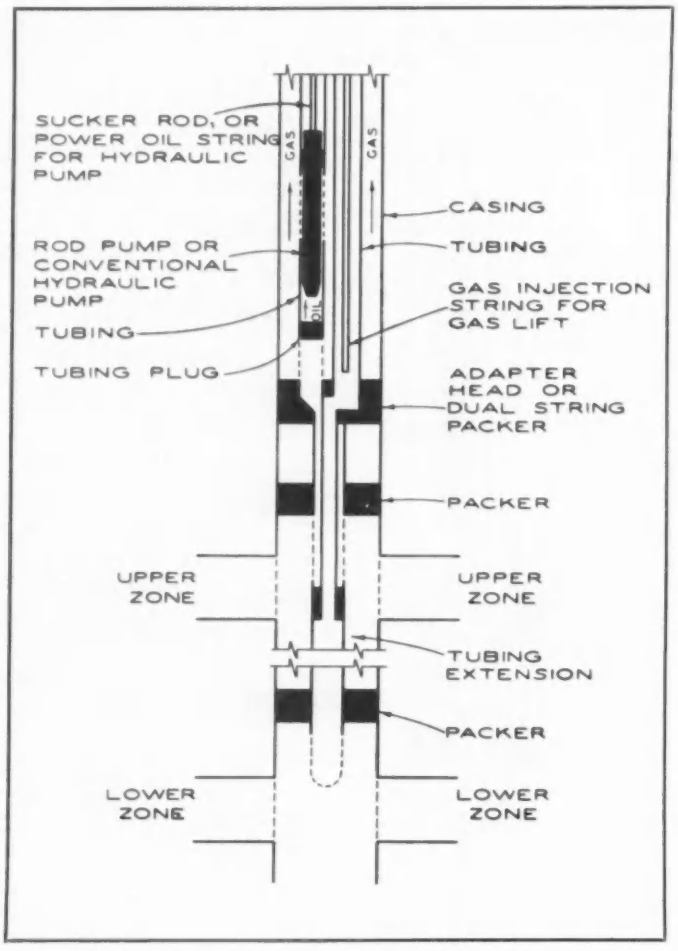


Fig. 13—Artificial lifting both zones may be accomplished by this system. One parallel string pumps oil from upper zone; other string with macaroni string inside gas lifts lower zone.

single completions of shallow to moderate depths, however, the author is unaware of any instance where this equipment has been used in dual completions. It has possible application where it is necessary to remove the gas from below a pump without using the casing annulus. An insert pump is run on small diameter tubing which is used in place of sucker rods. Fluid passes through the pump plunger directly into the small tubing through which it is pumped to the surface. A bypass around the pump hold-down seating ring allows the well fluid to rise in the annulus between the large and small tubing, and agitation caused by the motion of the small tubing helps to separate the gas which escapes to the surface. This method, if used in conjunction with parallel pumping strings, might provide gas separation systems for each of two pumps in the same well bore.

For dual-zone wells completed with 7-inch casing instead of 5½-inch, there is available a much larger number of combinations of lifting equipment. Of course, all of the systems previously discussed as applicable in 5½-inch pipe are also feasibly in 7-inch casing, with the advantage that greater capacity equipment can be installed.

Figure 12 exemplifies a proposed system where one 2-inch string provides a flow course for lower zone gas and the other 2-inch tubing provides the lower zone pumping string. The upper zone may be flowing, or a third, small diameter, string may convert the casing annulus to a gas-lift system for the upper zone. A parallel string adaptor head may be substituted for the dual zone packer; or if both types of packers are installed as shown, the tubing extension may be perforated between the two packers to enable better gas-oil separation.

A variation of the preceding installation is shown in Figure 13. The upper zone is discharged into the casing annulus above the dual string packer. Gas separation takes place in the casing and a pump placed in one tubing string provides a standard pumping installation. The lower zone flows through the other tubing; or it may be gas lifted by running in a gas injection string as shown; or a plunger lift installation may be installed. By appropriately designing the concentric tubing extensions below the dual string packer, the production system for each zone can be reversed with the lower zone discharging into the annulus.

To Broaden Application. It becomes apparent that the application of dual completion methods could be greatly extended by overcoming obstructions to providing pumping equipment, with sufficient capacity, to meet the needs of a greater number of reservoir conditions. Full potential advantages of a dual-zone completion are achieved when we can produce each zone for the same revenue, and to the same economic limit, as would have been obtained had the zones been singly completed. Listed below are some items of equipment which need to be developed to enlarge the application of dual completions.

- Dual-zone pumping equipment with effective bottom-hole gas-oil separation for each zone.
- Parallel tubing string elevators so designed that at all times each string will be individually suspended by its own top joint.
- A method of coupling one-inch sucker rods which would allow running 1-inch rods in 2-inch tubing. This would extend to greater depths the use of rod pumps in wells equipped with parallel 2-inch tubing.
- A mechanical hold-down anchor for parallel tubing strings. Where rod pumps are installed in dual-zone wells, this device would relieve movement of the packer seal nipples, and would eliminate differential movement between the two strings.
- Increased thread strength for small diameter tubing to be used as hollow sucker rods. This would permit running the type of installation illustrated in Figure 11 to greater depths.
- Casing packers having larger diameter internal openings than available with existing packers. This would allow passage of concentric tubing strings of more adequate size.

—The End.

ACKNOWLEDGMENT

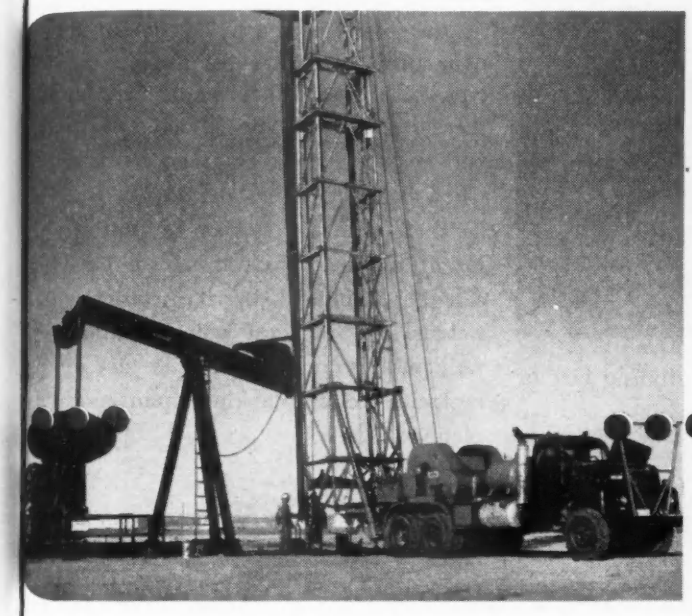
This was presented as a paper at Mid-Continent API meeting in Oklahoma City, March 19, 1954.

these well-servicing savings?

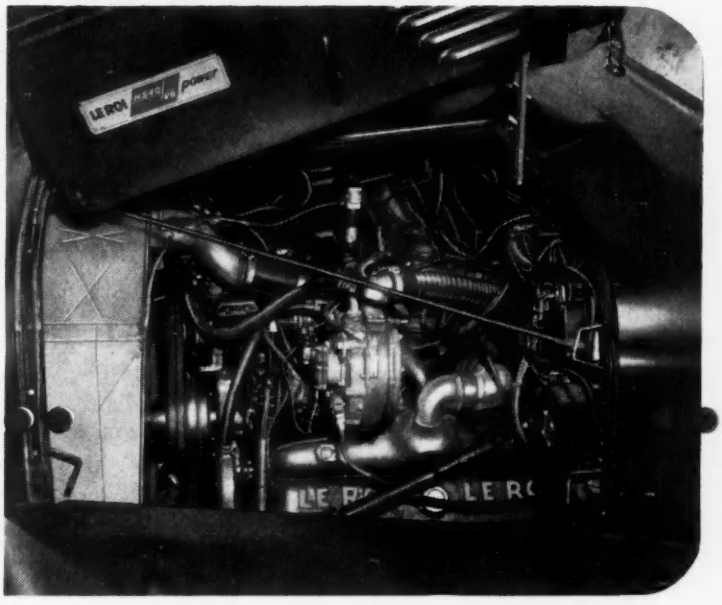
Major producer replaces original truck engine with LE ROI H540/V8

Saves as much as 7½ hours pulling 2½" tubing from 8,300' well!

Saves as much as $1650.00 over contract price of servicing well!



This Frank's well-servicing unit is powered by a Le Roi H540. Unit includes a 90' 150,000-lb. derrick. One major petroleum company operates H540-powered rigs like this in the Rocky Mountain area, Oklahoma City, and West Texas.



Le Roi's H540 is the first 200-hp, high-compression, valve-in-head V-8 engine for heavy-duty truck applications. It is only 45" long. Its power ratio is only 6 lbs. per HP — the lowest of all comparable engines. It burns gasoline or LPG.

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The figures above were established by one of the well-servicing units of a major petroleum company in the Rocky Mountain area. The original power unit in this rig was replaced by a Le Roi H540 200-hp V-8 engine. After the H540 was installed, 2½" tubing was pulled from a 8,300' well in 4½ hours. Previously, the elapsed time had been 10 to 12 hours. So, H540 power saved the company as much as 7½ hours' time.

This saving was reflected in the cost of servicing the well. Where the contract price formerly had been $1500.00 to $2000.00, it was reduced to an actual cost of only $350.00 with H540 power.

Now, that wasn't just an isolated case. The same company had a similar experience in a West Texas field. There, H540 power pulled 2½" tubing from a 9,700' well in 4 hours flat. Previously, the elapsed time had been a day and one-half or 12 hours' time. A saving of 8 hours was realized with H540 power.

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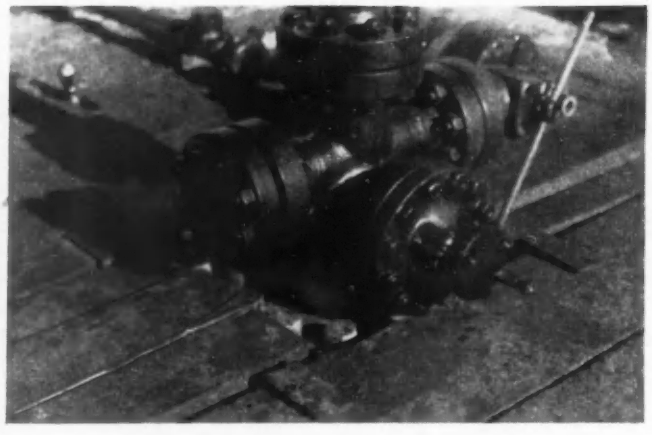
P-128

How to do it

PRODUCTION HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

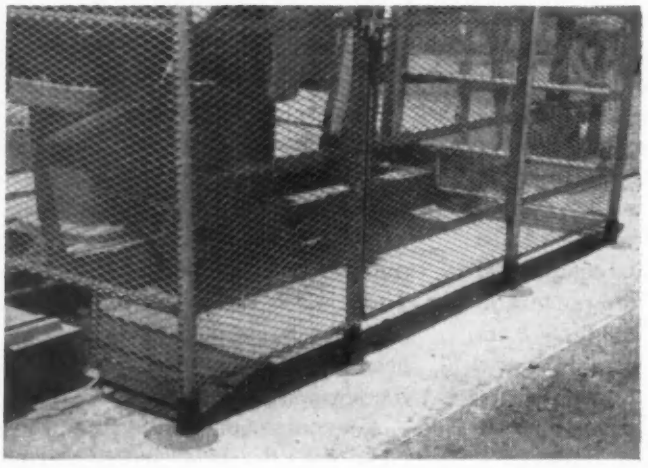
U-Clips Support Short Cellar Planks Around Wellhead



Two short planks, which butt up against the well head, ordinarily cannot be supported without some form of blocking or installation of metal strips which support the ends at that point. Frequently, after several pulling jobs, and particularly if crews are a bit careless when re-installing cellar coverings, supports for the two short planks begin to fall apart and create a hazard to those who must service the stuffing box or flow valves.

A permanent solution to this problem can be effected through the use of a pair of U-shaped pieces of one-half by three-inch strap iron, bent to fit the plank exactly and equipped with projecting ears to provide the type of support illustrated. Careful measurements of the plank's width and thickness must be taken so that, when installed, the short planks will lie flush with the surface of the adjacent full length planks. Such clips can be fashioned by the company welder and their use will encourage well pulling crews to exercise care in replacing cellar planking upon completion of the job.

Steel Plate Discs Hold Fence in Place



Installation of a fence around the pumping unit often involves the expenditure of considerable time and material in either (1) drilling holes in the concrete pad to receive fence post sockets; or (2) building of brackets and welding them to the I-beam skid base and on which the fence subsequently is mounted.

One operator has developed a system that combines the advantages of both, yet involves only a faction of the time either system would require. In addition, the method does not require precise before-hand knowledge of just where each fence post will fall when finally installed. Before pouring the pad, he estimates the probable position of each of the posts. After cement has been poured, and before it sets up, he presses into the wet concrete a suitably-anchored steel plate disc. These discs, flush with the concrete surface, are left until cement is hard and the fence is ready for installation.

As the fence is set up, plumbed and squared, each post is set inside a socket of pipe, the latter being a five-inch length of salvaged material cut from pipe of the next size larger than that comprising the fence posts. When the fence is completed and all dimensions checked, these sockets are welded in place on their respective steel plates. Even should last minute adjustments or miscalculations cause a post to fall near the edge of its anchor disk, no harm is done and rigidity of the installation is not affected. Use of this time-saving, flexible system can save many man-hours in the final completion of a well.

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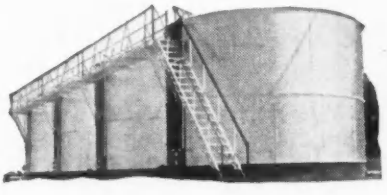

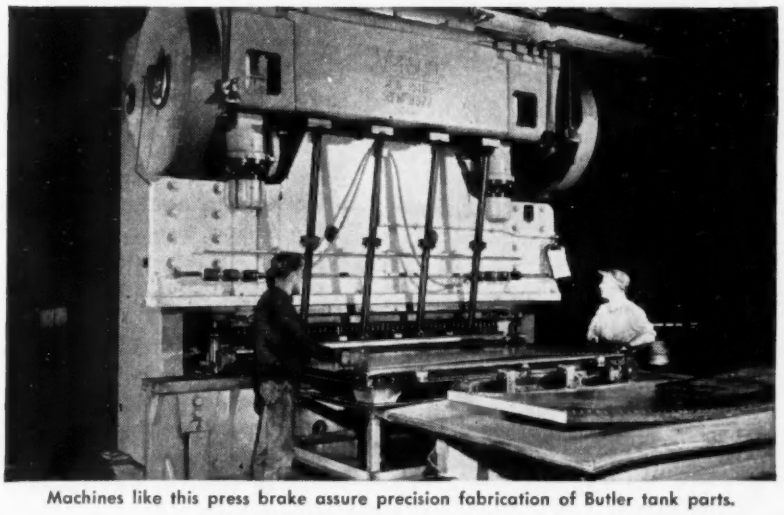

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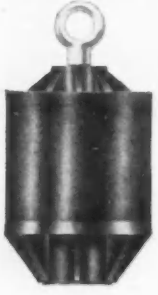
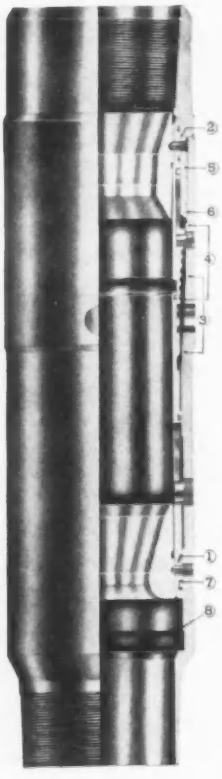


Bottom plug with eye hook

Weighted Trip Ball



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The line consists of a piece of 3-inch pipe which is swaged down to 2-inches at the top. The 2-inch line is laid to a convenient point for the water to be discharged. The 3-inch line is perforated at the bottom so that it will not become clogged.

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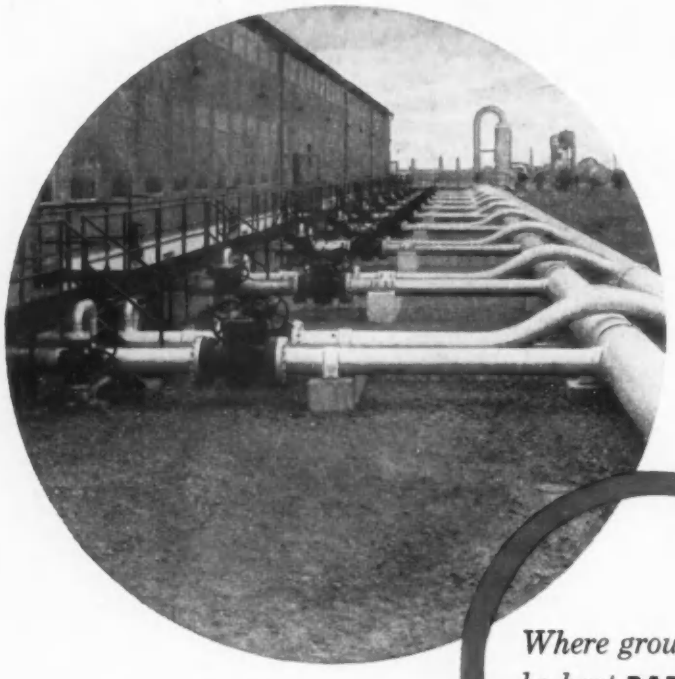

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3-inch section. Cut a hole in the 3-inch line just above the perforations, and insert the ¾-inch pipe after it has been reduced to ¼-inch and pointed back up the pipe.

The jet line is laid in the lowest part of the tank dike enclosure and the gas connected to the separator. To empty the dikes, the gas is turned on the water easily jetted out.

Gas-Oil Ratio Meter Vented to Riser

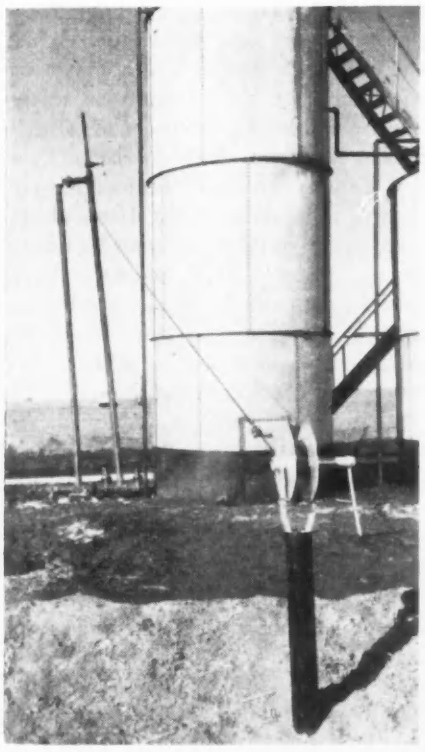
The simplest connection on the vent line for running gas-oil ratio tests is a tee and gate valve installed on the vent line riser. The tee carries a bull plug which is connected by hand into the side of the vent.

When it is necessary to check the amount of gas being flared, it is only necessary to unscrew the bull plug,

connect up the orifice well tester and close the gate on the riser. The valve on the side connection is eliminated because the connection is so near to the end of the vent line that no gas will blow out when the change is made from the bull plug to the orifice well tester.

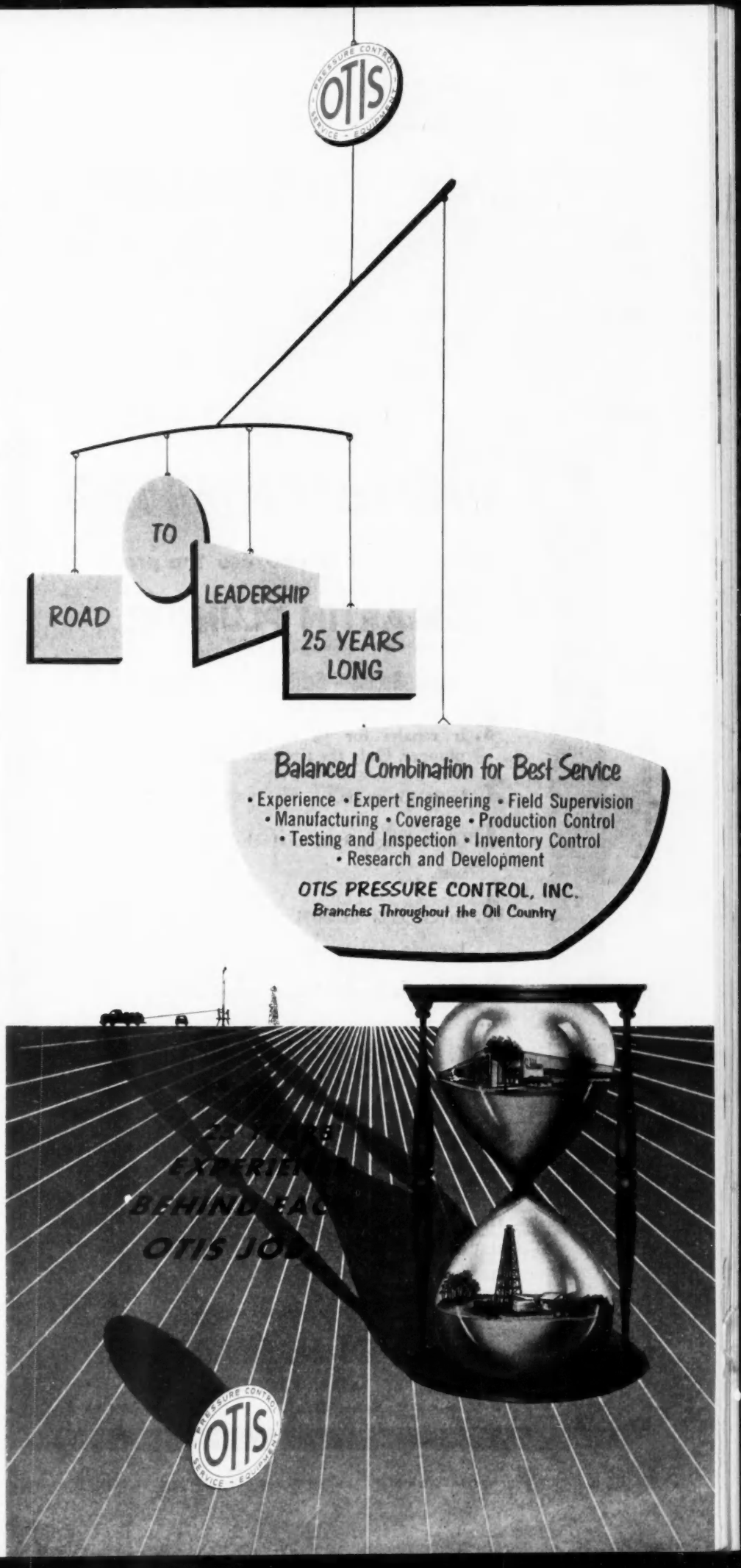
Since the gas must be vented on the downstream side of the tester, the escaping gas is no more dangerous than when the orifice well tester is in operation.

As soon as the orifice connection is made, the gauge is connected by means of a rubber hose and the rate of gas flow can be determined easily for a 24-hour period. The amount of gas produced divided by the barrels of oil is the gas-oil ratio, measured in cubic feet per barrel.



Hand Winch Controls Salt Water Overflow

Here is a way to control the salt water level in a gunbarrel tank. The usual "grass-hopper" leg is installed with both legs on the same plane of rotation so that they will swing through the same arc. A gate valve is placed between the feet of the legs so that the tank may be drained through



the same salt water connection if desired.

At the flange at the top of the leg, a piece of steel sand line is attached which comes down to the homemade spool. The spool is made from a short piece of 3-inch pipe set in concrete. The upper end of the pipe has been cut and spread to provide bearings for the spool. The bearings are made from one-inch pipe and the shaft made from ¾-inch pipe. The handle is welded to the end of a ¾-inch shaft.

Sides of the drum are made from circular pieces of tank iron, welded to the ¾-inch shaft. Wire from the top of the leg is run through a hole in the shaft and the crank run up to hold the leg at the right angle. The drum is held in position by a large clip which is run through holes in the edge of the drum and allowed to fall back against the clevis of the riser.

Skid Hookup Pipes Gas From Wellhead to Engine

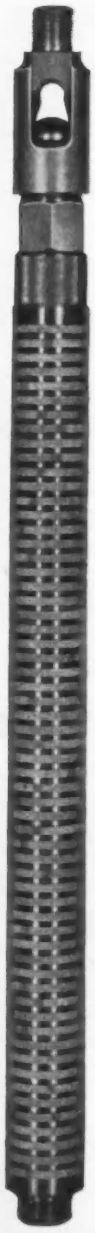
On portable pumping units, the pipe frame used for skids may also be used for scrubbing the casing head gas and carrying it from the well head to the engine. This also allows for a permanent type hookup between the pot and the engine. When the unit is spotted, it is only necessary to connect up the casing head to the nearby connection on the skids with a rubber hose and whatever connections are handy. Another connection, not shown, is made near the front of the unit where outside gas may be added to the system. This makeup gas is usually controlled by a regulator set at a low pressure so that all of the casing head gas may be utilized before outside gas is brought in.

The pipe frame is made in the usual manner out of 4½-inch drill pipe. All welds are made solid and the frame is tested for leaks before leaving the shop. A drain connection is made on one corner so that any entrained liquids may be removed. Two inlet connections and one outlet connection are made, the pumping unit mounted on the frame and the equipment is ready for operation.

Load Is Balanced In Rotative Gas Lift

When separator gas is recompressed and rotated through wells, it is difficult to keep the load steady on the compressor plant when the wells are on intermitters which produce rather large gas heads at times and no gas at all between heads.

A foolproof arrangement for connecting up can be made by the proper



Patent No. Re20574

LOW COST PUMPING!

You have it if you use the proper

MARTIN PLUNGER

Grooved Bodies—Split Rubber & Duck Rings

1. It repairs for ⅓ to ¼ the cost of a new plunger. Only the rings are replaced.
2. Lasts for years.
3. Gives longer runs and therefore less pulling cost.
4. Saves 50% to 80% on barrel or tube cost because of slow rate of wear.
5. Increases production in many cases.

SAND FRACtured wells, for example, can be extra hard on ordinary pumps, but many Operators are finding it easy to handle the sand with Martin Plungers. They handle salt water, sand and any gravity of oil from any depth to 10,000 ft. more economically than any other equipment. They may be used in stroke-thru installations when necessary.

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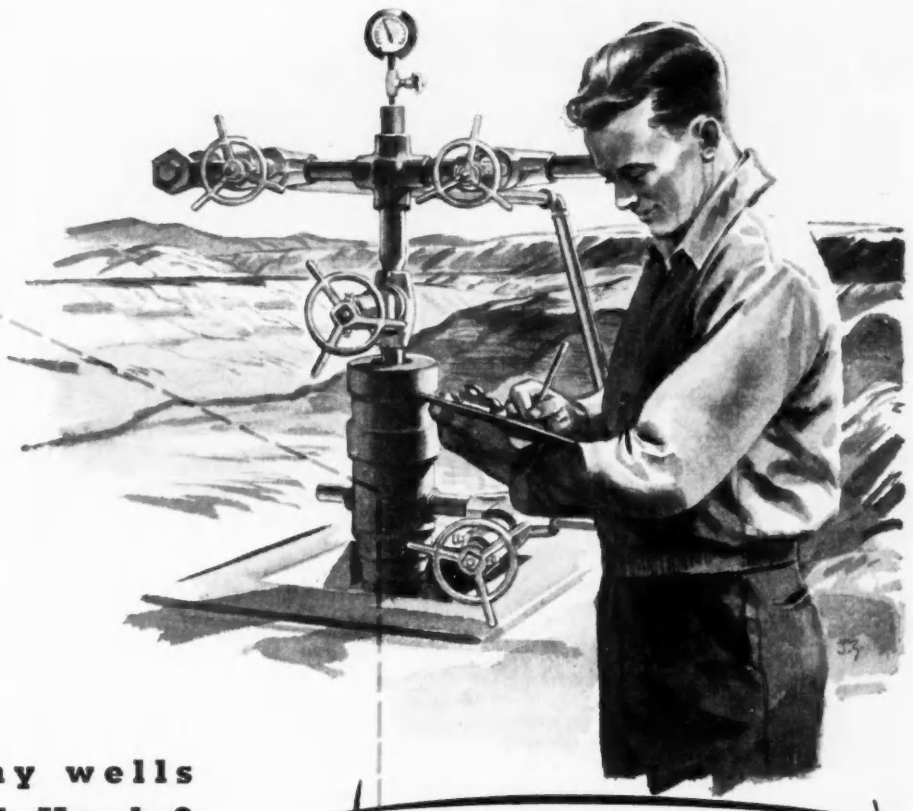


Why do so many wells have Gulfco Well Heads?

With GULFCO Well Heads, you get the benefits of 35 years' experience. This means simpler completion procedures, greater safety and lower over-all costs.

Simpler completions are assured by the wide variety of field proven interchangeable hangers available.

Greater safety is assured because all parts are made of forged steel for strength and uniformity.

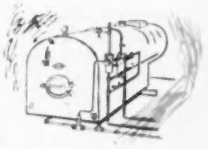
Lower costs are assured because you get the right equipment for the job—priced right—for every well.

Call your nearest GULFCO representative for full information.

Forged Steel Xmas Trees

Slip-on Weld Casing Nipples and Collars for quicker tubing head installation

Oil Field Boiler Burners . . . Gas and Feed Water Regulators



See GULFCO 20-page section in Composite Catalog

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4777

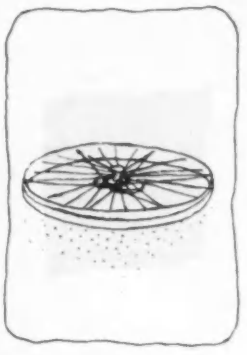
HARBISON-FISCHER

PATENTED

Texas Stripper

ROD PUMPS

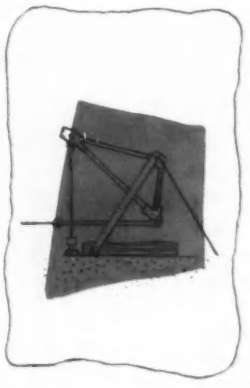
for sandy wells



Conventional pumps set in sandy stripper wells often sand up during shut-down periods when sand in the oil column settles around the plunger. Sometimes a tubing job is necessary to retrieve the pump in order to free the plunger.

An outer jacket tube on the Texas Stripper Rod Pump prevents sand from entering the pump; instead sand settles around the pump, and the plunger is not directly exposed to the fluid column. In operation, oil is drawn through the pump in the conventional manner but is discharged through ports in the barrel tube into the annular space between the outer jacket tube and the barrel tube. As the fluid is discharged at the bottom of the skirt the flow action is somewhat agitated which tends to flush sand upward and away from the pump hold-down.

Texas Stripper Rod Pumps (Patented) are available in 1 1/16" bore for 2" tubing and 1½" bore sizes for 2½" tubing, and in a wide range of plunger and barrel tube combinations. Illustrated bulletins giving full information on these and other Harbison-Fischer pumps are available without obligation through leading stores in all major producing areas, from our factory representatives, or by writing us at P.O. Box 127, Fort Worth, Texas.



Harbison
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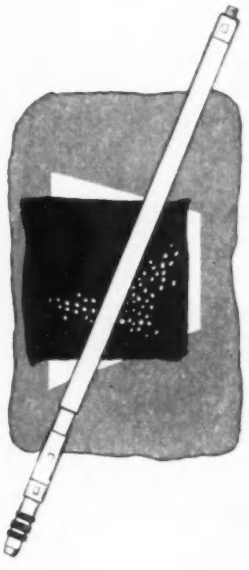
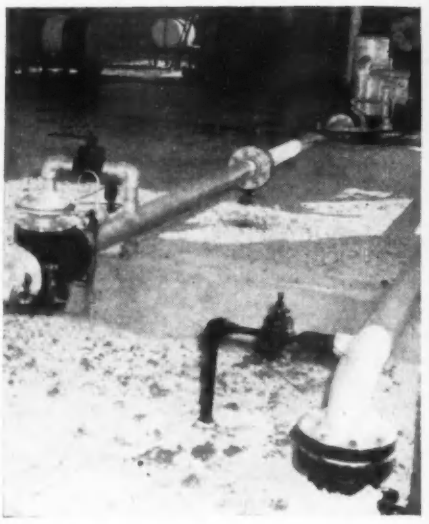


H·F
OIL WELL PUMPS

HINTS . . .



arrangement of the regulators. As shown, gas comes in at the left in the photograph from a field scrubber and flows through a regulator in the line which is set at 40 pounds per square inch on the downstream side. This prevents the inlet pressure on the compressors from ever exceeding 40 pounds as long as gas is available. Excess gas from each flowing head is popped off through the regulator on the side connection shown at the left in the photo.

A second regulator is set on the side of the line near the compressors. When the wells are producing dead liquid and no gas is available to run the plant, the regulator on the side connection opens when the pressure on the inlet falls to 35 pounds. This provides a constant flow of gas to the compressors, which are never overloaded nor running off due to no load.

Chemical Drum Rack Makes Draining Easy

Make a simple barrel rack for chemical drums from sucker rod to perform a double job. Use of the rack enables one man to place the heavy drum in a horizontal position from which the contents may be drained as needed. As the drum becomes empty, the long handles make it possible to tilt the drum forward so that practically all the chemical may be drained out.

Weld the drum rack in the form shown, and brace it with only one cross bracing member near the center of the rack. The handles of this rack,

SECONDARY MODERN RECOVERY

TECHNICAL CONSULTING
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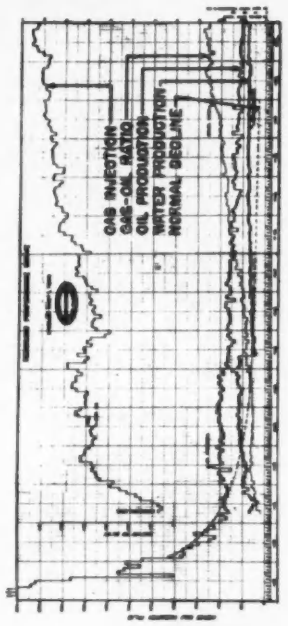
PRESSURE MAINTENANCE WITH GAS OR WATER

REPRESSURING WITH GAS OR WATER



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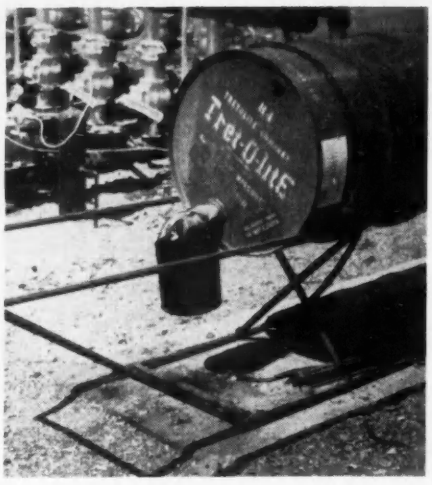
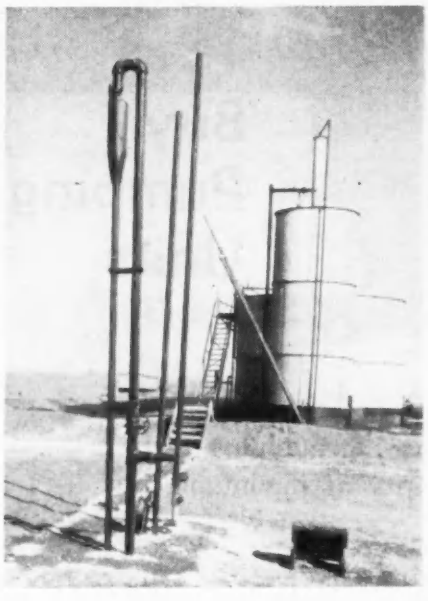
HINTS . . .



considerably longer than those normally found on such racks, ease the job of draining out most of the chemicals from the drum.



Flare Line Hookup Carries Liquid to Pit

On leases where gas is flared, it is convenient to have the flare near the center of activity to provide light at night. But if the separator overflows, there is danger of the burning liquid running over the ground. One company provides a line from the burning pit back up to the top of the flare line, so that gas can be flared and burned at the most convenient spot, yet liquids, if any, will be carried to the pit.

The hookup is simple and requires little more pipe than if the flare were run directly to the pit. The vent line is laid down and a return bend is inserted on top by means of two ells and two nipples. A riser is screwed

PUMPING PROBLEM

REDA MAY HAVE THE *RIGHT* ANSWER

. . . from ⅓ HP to 240 HP . . . from 20 bbls to 17,000 bbls . . . from 200′ to 10,000′ and more . . . Yes, a REDA may do that pumping job BETTER . . .

Reda Pumps are accepted as original equipment, or replacement equipment, because they produce at a lower cost per barrel of fluid. Whether it's large volumes from shallow depths, or modest volumes from great depths, Reda Pumps provide operating savings.

IMPROVED DESIGN:

Constant research and design improvement are responsible for lengthened operating life; corrosion resistance, low labor cost per barrel of fluid produced.

IMPROVED EFFICIENCY:

Greatly improved overall efficiencies have improved Reda performance as much as 25%; a substantial operating saving.

If you have a pumping problem, our engineering staff is always ready to assist you. Phone or write:

REDA PUMP COMPANY

BARTLESVILLE, OKLAHOMA

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

to the end of the line from the pit and a homemade funnel made for the top by swaging it out from 3 inches in diameter to 6 inches. Both sections are raised and clamped together so that each one supports the other.

Ends of both the six-inch and four-inch lines are cut on a mitre so that the pumper can see at an instant if the separator is "kicking over." The amount of oil saved in one "kickover" will pay for this setup.

Bumper on Gang Truck Has Multiple Uses

The bumper of this gang truck has been utilized for several purposes, from pipe rack to work bench. Made in the welding shop of one-inch and three-inch pipe, the bumper of this truck contains a rack for a water cooler, a paper cup dispenser, pipe racks and a pipe vise.

The cooler is held in place by a leather belt strapped tightly around it and fastened to the grill work of the bumper. The pipe vise bolts to a horizontal steel plate which has been welded to the three-inch horizontal bumper. It is at a convenient height for cutting or threading small diameter pipe. The two pipe racks at the upper ends of each side of the guard are somewhat standard, and they support the forward end of pipe, rods, timber, etc.

This bumper guard design has proven satisfactory in several years of use. The water cooler is always handy, easy to fill and wash out, and remains out of the way.

Here's How To Buy Pumping Units

First of all, the reason for buying pumping units is to lift oil—the maximum quantity at minimum cost.

With this reason in mind, look carefully into specifications and performance figures. Note prices and operating costs. Talk to other producers—to Jensen owners—and, even more important, talk to your JENSEN Dealer.

Get the facts about JENSEN's 34-year record of outstanding performance.

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Use the Readers' Service Cards

For more data on New Equipment described and for copies of Catalogs and Literature reviewed in this issue, use the Readers' Service Cards inside the back cover. Circle the code numbers of the editorial items desired and circle the page number for more information on advertised products. Sign and mail the card. Requests will be sent to the manufacturer, who will forward information to you.

A LESSON IN AMERICANISM. Prof. John Quinton, a full-time lecturer for Service Pipe Line Company, conducts a "Let's Talk It Over" program before a non-company group.

Service Is Selling Americanism

A pipe line company has brought the fight against Communism out in the open. And they're finding the ideology is easily routed when the people understand it.

By ANTHONY GIBBON, WORLD OIL Staff

IN A PIONEERING educational experiment, Service Pipe Line Company of Tulsa, Okla., has proven that school age youngsters, housewives, in fact all segments of the nation's population, abhor the ideology of the Communists once it is clear in their minds.

A year or so ago Stanolind Oil and Gas Company started a program to explain to its employes the advantages of the American way of life. The program, "Let's Talk it Over," caught on. It was adopted by other oil companies, among them, the Service Pipe Line Company.

Designed for Employes. For several months "Let's Talk it Over" was presented to Service Pipe Line Company employes. Several college professors were employed during the summer to conduct the classes. The classes often were attended by other than pipe line personnel. Soon a distinct demand for the courses appeared from outside sources. Community leaders expressed the hope the programs might be presented to their local groups. Many requested the programs be presented to their church, civic or fraternal groups.

So great was the interest along Service Pipe Line Company's territory that management, conscious of its community responsibilities to develop attitudes favorable to the private enterprise system, decided to bring the "Let's Talk it Over" series to the people.

So far as can be ascertained, it is the only program of its type presented to the public by a business concern. It brings the fight against Communism out in the open. There are no "gimmicks" attached to the program unless it be Service Pipe Line Company's belief that if it is to stay in business, America must stay in business also. The program is available from Stanolind Oil and Gas Com-

pany for presentation to employe or public groups.

Full-Time Consultant. Prof. John Quinton of the University of Tulsa, a psychology instructor, was engaged as a consultant to conduct the programs. The Nebraska division was determined a representative area in which to start the first series of "classes" in "Let's Talk it Over." The discussion leaders are trained not to introduce their own ideas or feelings into the discussions. As moderators only, they supply facts on matters the group has under discussion.

Quinton keeps two courses running simultaneously. He usually has one course for school children during the day and sessions for adults at night.

4-Point Course. Here's how the "Let's Talk it Over" sessions are conducted: The course is divided into four sections, each lasting about 1½ hours.

The first session deals with the basic ideas of Communism; next comes the spread of Communism as a threat to the U. S., followed by a discussion of the capitalistic free enterprise system. Finally the discussion turns to the duty of citizens to retain their freedoms.

Each member of a discussion group is given three paper back books, "If You Were Born in Russia," "Miracle of America" and "Understanding Politics."

During the talks Quinton uses a flip chart which consists of a series of main discussion points printed on large sheets of paper. He flips these charts as the discussion progresses.

The ideal discussion group numbers about 30, but there have been as many as 150 at one discussion. In the smaller groups members discuss issues more freely. Often the size of the group is doubled by the last session.

Probably the most successful feature of the "Let's Talk it Over" classes has been noted in the scholastic field where Quinton has taught the doctrine of free enterprise to young Americans. He opened the first program in the Mitchell, Neb., high school with 300 students and teachers participating. This was on October 6 of last year. The programs were presented in four 1½-hour sessions for four days.

During the evenings of the same period, October 6-9, Quinton presented the program to the Mitchell Kiwanis Club with from 20 to 29 businessmen and civic leaders attending each of the four evening sessions.

These programs launched a series that continued until December 24 in the eight key communities along the Nebraska division segment of the Wyoming-Freeman line.

In addition to schools and service clubs, church groups, extension clubs, a parent-teacher organization, college classes, women's clubs, a professional organization, a Knights of Columbus group, an American Legion post, an AAUW chapter, a Chamber of Commerce, and a complete high school faculty participated in the programs.

If there is a single key thought to the many advanced in the series of discussions, it lies in the Communist theory of: "From each according to his ability; to each according to his need." This bit of philosophy from Karl Marx is forcefully rejected by American youth.

When the leader points out that the controllers of the means of production in Communism hold the power; and that human beings are in the main means of production, any appeal Communism may have had is shattered. After discussing these facts most groups usually decide that: "If you own the means of production like they do in Russia then you own the men and women too." The discussion has reached its climax when this reasoning comes from the participants.

Communities Endorse Series. The program's acceptance has been gratifying to the company. For example, from eight smaller towns in Nebraska, to date, the company has received 143 letters bearing 217 signatures expressing sincere appreciation of the program. Most of the letters contain invitations to return to the community with another program. Many of the letters were signed by one person representing a large class or group. In addition, district superintendents at Scottsbluff and Kearney, Neb., reported receiving many commendatory telephone calls.

The general tone of the letters reflects a considerable understanding of the American free enterprise system and expresses an earnest desire that it be protected. Several letters, however, place a particular value on the programs because they serve to stir dormant minds to the realities of Communism, or to clarify Communism as an ideology to the confused mind.

Following are extracts from a few of the letters which Service has received:

A Cozad, Neb., high school student: *"I have learned more (about Communism-Capitalism-Democracy) in one talk than I did in one semester of school."*

Five Cozad high school students jointly signing a letter: *"Most important, however, we feel that we are now immune to communist propaganda because we have learned the evils of this kind of government."*

A North Platte high school student: *"I hope that there are more programs of this type to help stop the people who are ruining this great nation of ours."*

Twenty Oshkosh high school students jointly signing a letter: *"They (the programs) made us realize the importance of education in maintaining our democracy. We are sure we will all be better citizens because of your lectures."*

A Mitchell junior high school math teacher: *"I think those were the best talks we've ever had here at school, in my 11 years here."*

One of the finest tributes to the "Let's Talk it Over" programs is a letter from a Kearney, Neb., mother:

"Of my experiences as the mother of five children, my most thrilling are those when my children have been intellectually stimulated. I have had that happy experience the last ten days or so . . .

"Please convey my thanks to your company for making such a fine speaker available to our schools."

If it takes fire to fight fire, Service Pipe Line Company, with its "Let's Talk it Over" programs throughout its territory, is doing a whale of a job to sell Americanism and to unmask Communism for what it really is.

Just as long as people want to hear the truth, Service Pipe Line Company aims to continue its series. Perhaps other oil companies and industries would like to take a hand in "selling America"! —**The End**

Rules of Thumb

FOR THE PIPELINER'S NOTEBOOK

$15 Per Rule of Thumb

These formulae from the pages of engineers' own notebook yield rough, but reasonably accurate answers for design, maintenance and supply questions. The Editors will pay $15 for your pet Rule of Thumb. Consult the index on page 243 of November WORLD OIL to find the complete classified list of all Rules of Thumb published thus far in the series. Send your Rule of Thumb to Donald M. Taylor, Pipe Line Editor, WORLD OIL, P. O. Box 2608, Houston 1.

Corrosion Protection

—8—How to find the voltage rating of a rectifier if it is to deliver a given amount of current through a given ground bed (graphite or carbon).

Multiply the desired current, in amperes, by the total resistance of the ground bed, in ohms (either calculated or measured); add two volts, to overcome the galvanic difference between graphite and protected steel.

Example: A current of 20 amperes is desired from a ground bed whose resistance is 0.9 ohms.

$(20 \times 0.9) + 2 = 20$ volts; specify the next larger size, which will probably be (depending upon the manufacturer) 24 volts.

Note: where the resistance is measured rather than calculated, and is the total loop resistance between pipe and ground bed, this method is quite precise; for calculated values, caution should be observed.

Miscellaneous

—12—How to estimate length of material contained in roll.

Where material of uniform thickness, like belting, is in a roll, the total length may be obtained by the following rule:

Measure the diameter of the hole in the center, and of the outside of the roll, both measurements in inches; count the number of turns; multiply the sum of the two measured diameters by the number of turns, and multiply this product by 0.13; the result is the total length of the material in feet.

Example: A roll of belting contains 24 turns; the diameter of the hole is two inches, and of the outside of the roll is 13 inches:

$$(2 + 13) \times 24 \times 0.13 = 46.8;$$

the roll contains 46.8 feet of belting.

Note: The rule can even be applied to materials as thin as pipe line felt; counting the turns is not as difficult as might appear without a trial.

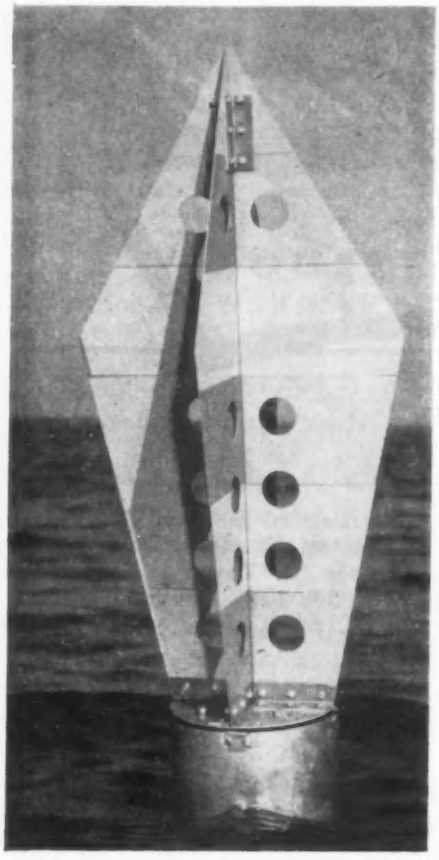
Corrosion Protection

—9—How can the resistivity of fresh water be determined from the chemical analysis?

Divide the total solids expressed in parts per million into 500,000; the result is the resistivity in ohm-centimeter units.

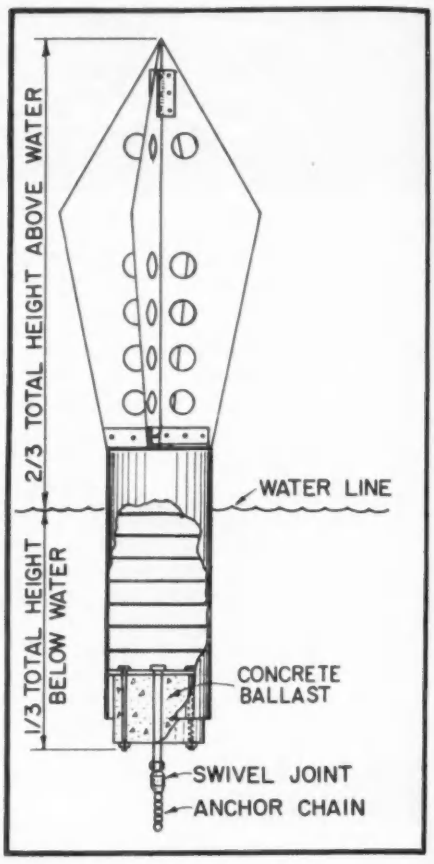
Example: Total solid content is 400 ppm.; $500{,}000 \div 400 = 1250$ ohm centimeters resistivity.

This rule of thumb will give very accurate results for any naturally occurring fresh waters; severely contaminated waters may differ markedly, however, depending on the kind of contamination.



SOMETHING NEW. A buoy that floats two-thirds above the water line. Note that can portion of buoy is not watertight. Plastic foam inside furnishes buoyancy.

- **It is inexpensive and virtually unsinkable.**
- **Even the rifle bullets of seagoing sportsmen can't damage it.**
- **It resists corrosion and the attack of sea life.**
- **It has two-thirds freeboard which makes it useable in shallow water.**
- **It glows in the dark and has a shape easily identified on radar.**



HOW IT'S MADE. Notice that anchor chain is insulated from rest of the buoy with concrete ballast. Its' shape makes it easily detected by radar.

This new type buoy provides a . . .

Better Marker for Underwater Lines

By **NATHAN H. JONES,** Buoys, Inc., Houston

BUOYS ARE playing an increasingly important role in offshore pipelining and drilling operations. There are channels and obstructions to be marked as well as the locations of underwater pipe lines. A new buoy is cutting costs and maintenance in this field.

Typical of the problems facing a pipe line company operating offshore was the 24 mile stretch of submarine line laid off southern Louisiana. The line needed permanent markers. Conventional methods of driving three strand piling, equipping each marking unit with Coast Guard-approved marine lanterns and fog horn devices, plus the expense of materials and man hours for maintenance would have brought the total cost of the installation to a staggering half-million dollars.

Yet for less than one-tenth that amount, the line was equipped with buoys of the type shown in the illustrations.

Specifications. A year before a number of engineers had begun a research program to develop a low cost, all-purpose buoy. It would have to meet Coast Guard specifications yet be light in weight. For shallow water installations it should have more freeboard than draft. It had to be unsinkable . . . and that meant it would be the first buoy developed *without* a water-tight air compartment for the buoyant section.

Another specification called for non-corrosive metals throughout, impervious to wind, salt spray and sun. These exacting engineers even wanted a buoy that would not be affected by adhesions of sea life such as seaweed and barnacles. This was to exclude the need of relieving the buoy for cleaning. Still another—and important—problem to be overcome was the insidious action of electrolysis

Continued on Page 238

Protecting Pipe Lines With Zinc Anodes

• A discussion of their application in cathodic protection, including effects of zinc composition and backfill composition.

• What to expect from zinc anodes and their limitations.

By E. A. ANDERSON, The New Jersey Zinc Company, Palmerton, Penn.

ZINC ANODES have been found effective in cathodic protection of underground structures such as pipe lines, and while literature contains many references to the use of zinc anodes, little has been said about the characteristics of the metal itself.

While next to last in the alphabetical listing of the metals, zinc is 30th in the table of the 92 natural elements and second among the nonferrous metals in tonnage produced. Occurring in ores, usually as zinc sulfide, distributed world-wide, the metal is recovered by furnace processes using carbon as the reducing agent, or by the electrolysis of solutions from acid leaching of the ore. Since most zinc ores also include lead and cadmium bearing minerals, the recovered metal will contain varying quantities of these impurities.

Six composition grades are recognized under A.S.T.M. Specification B 6-49 and are listed in Table 1.

Of these grades, those designated as High Grade (99.9 percent pure) and Special High Grade (99.99 percent pure) have been found satisfactory for anode use but Special High Grade is required where the anode is to have a long service life. While all of the needed research has not yet been carried out, it appears reasonably certain that iron and, possibly, lead and cadmium promote a tendency for the anodes to become passive even in backfill environments which are well suited to zinc.

TABLE 1
Standard Grades of Slab Zinc

GRADE	MAXIMUM IMPURITIES—PERCENT				
	Lead	Iron	Cadmium	Aluminum	Total
1a Special High Grade	.006	.005	.004	None	.01
1 High Grade	.07	.02	.07	None	.10
2 Intermediate	.20	.03	.50	None	.50
3 Brass Special	.60	.03	.50	None	1.0
4 Selected	.80	.04	.75	None	1.25
5 Prime Western	1.60	.08	....	....	....

TABLE 2
Characteristics of Zinc Anodes

Specific Gravity	7.133
Pounds per Cubic Foot	446
Theoretical Ampere Hours/Pound	372
Theoretical Pounds per Ampere Year	23.5
Normal Current Efficiency—Percent	90+
Practical Ampere Hours/Pound*	335
Practical Pounds per Ampere Year*	26
Solution Potential—volts†	—1.1
Electrical Conductivity—percent of Cu	28

* At 90 percent efficiency.
† Against copper sulfate reference electrode in suitable backfill.

The characteristics of zinc which may be of most interest in cathodic protection work are listed in Table 2.

It is generally considered that an underground steel structure has been protected when its potential against the copper sulfate reference electrode has been increased to —0.9 volt. Actually, important reductions in corrossion rate are obtained at potentials somewhat lower than this. On the other hand, an increase in potential above —0.9 volt not only produces no improvement in protection but may be harmful. At about —1.1 volt hydrogen can be evolved on the steel with mechanical disrupting effects on the protective coatings. The alkalinity of the moisture immediately adjacent to the structure increases with the current density and may, under the influence of very high currents, reach levels detrimental to organic protective coatings.

The —1.1 volt value for the solution potential of zinc has several consequences which must be considered in practical applications. At the outset it is apparent that the restrictions imposed by Ohm's law require that zinc be used in a low resistance circuit if sizable current outputs are to be obtained. The widest application of zinc anodes is in waters or soils below about 1500 ohm-cm. resistivity. Zinc has been used successfully, however, in higher resistivity media to provide insurance protection to well coated structures.

In the lower resistivity soils the low solution potential of zinc offers an important safeguard in that, except for the unlikely possibility of a circuit of zero resistance, it should be impossible for a zinc anode to polarize a steel structure to the —1.1 volt potential needed to release hydrogen. A further corollary of the low resistance requirement is that a fairly large increase in current demand can be met without serious decrease in structure potential. With a suitably low resistance a 50 percent increase in current output would only result in a decrease in the potential of the steel from —0.9 volt to —0.8 volt.

Since the only purpose of a protective anode is to provide current

while corroding any loss of metal by processes which do not result in useful current is wasteful. Where data from actual service installations are available, the zinc anodes have delivered 90 percent or more of the theoretical current. This factor is useful in designing installations for long anode life.

Backfill Environment. Historically, one of the first underground installations of zinc anodes was made in Colorado in the '30's. These anodes maintained a high useful current output throughout their life. Later installations in a variety of soils resulted in a spotty performance record. In many locations the anodes quickly became passive and ceased to deliver current. In others good current output was observed so long as the anodes lasted. It is a tribute to the keenness of observation of the corrosion workers that they soon noted that good results were obtained only in soils which contained natural gypsum ($CaSO_4.2H_2O$).

From this observation developed the present practice of back-filling around the anode with a gypsum-containing mixture. A favored mixture includes bentonite clay and hydrated gypsum in 75:25 ratio for moist soils ranging down to 25:75 for high resistivity soils. Addition of the backfill on the job is preferred to a packaged anode arrangement.

It was a matter of both technical interest and practical importance to determine the mechanism by which the gypsum prevented the anode passivity otherwise encountered. A study[1] revealed that in the absence of sulfates, the natural soil corrosion product on zinc is a dense, impervious film of basic zinc carbonate. In the presence of sulfates, the basic carbonate reaction will still occur until the carbon dioxide immediately available in the ground water has largely been consumed. At this point the reaction changes to that which produces basic zinc sulfate as the end product. This latter salt forms as a mat of intertwined needles or plates having abundant porosities which permit conduction of current through permeating ground water.

Zinc Anode Shapes. In much of the earlier work with zinc the anodes were made by bending heavy gauge rolled metal into a cylinder to which the insulated lead was fastened by soldering. There are distinct advantages, however, in the use of cast-in steel cores. Sections of an anode which have become separated by local corrosion are not electrically isolated and hence continue to contribute current to the protected structure. Lead wires can be strongly brazed to the steel permitting the safe and convenient use of the wire as a means for lowering the anode into the hole.

Molten zinc reacts with iron and bonds to it through the formation of a series of intermetallic compounds. This mechanism has long been known and understood in the hot dip galvanizing of steel and, indeed, a zinc anode with a cast-in steel core may be regarded as a galvanized product of extraordinary coating thickness.

While, within reason, almost any desired shape and size of zinc anode can be cast, there are real advantages to restricting anode designs to a relatively small number of shapes. Sizes such as the following would seem to fill most needs:

1.4" x 1.4" x 9" weighing approximately	5 lbs.
1.4" x 1.4" x 60" weighing approximately	33 lbs.
2" x 2" x 60" weighing approximately	65 lbs.
4" x 4" x 36" weighing approximately	160 lbs.

Greater lengths can be obtained by welding the core rods of two or more anodes together.

Current Output from Zinc Anodes. The current delivered by a zinc anode will be controlled by a number of factors such as the soil resistivity, the geometry of the installation, the proximity of other anodes and the anode area. The anode life in turn will depend upon the current output and the initial weight. Typical figures for a 1.4 x 1.4 x 60-inch anode used alone would be 42 milliamperes current and 30 years life in 1100 ohm-cm. soil and 94 milliamperes current and 14 years life in 500 ohm-cm. soil when working with a 0.2 volt driving potential against a structure polarized to —0.9 volt. —**The End**

ACKNOWLEDGMENT

Much of the background for this article was taken from "Cathodic Protection with Zinc Anodes," dated June, 1953, prepared by Ebasco Services for the American Zinc Institute.

REFERENCE

[1] E. A. Anderson, *Corrosion*, 6, p. 129-131, April, 1950.

Better Marker

Continued from page 236

that ate away mooring chains . . . an electrical action set up in salt water between metals of different types.

The result of this research was the buoy shown here. It met the exacting specifications and offered still other features. Bonded to the big marking fins was a wide-angle reflective surface with a brilliance 200 times brighter than a white, painted surface. At night they could be easily seen at distances beyond two miles. For radar detection in fog and bad weather the shape and physical proportions of the marking fins offered an ideal reflective surface.

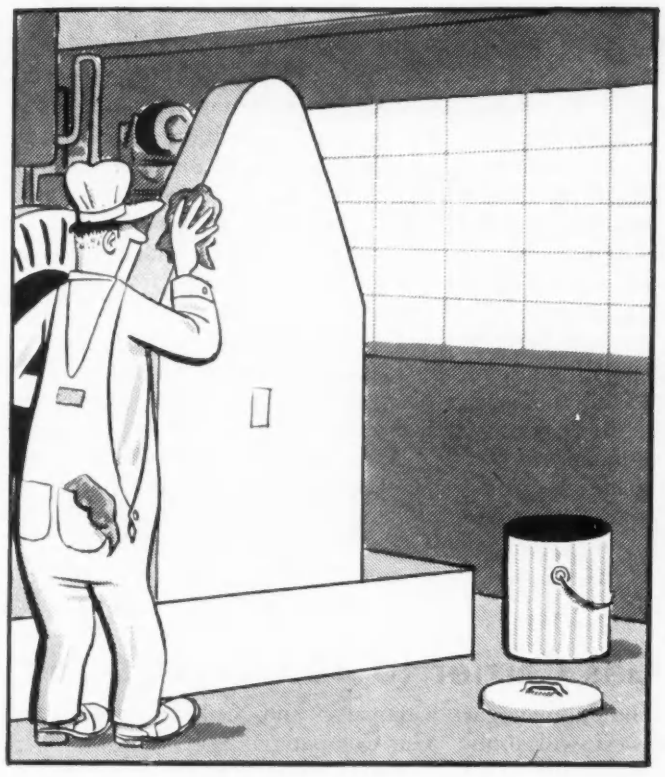
When accidentally hit by a barge or boat the cylindrical buoyant section would spin on its swivel mooring-chains sink below the surface and bob up again unharmed. Even the bullets of seagoing "sportsmen" would not sink it. Composed of a new by-product of oil and synthetic rubber, the buoyant section was as impervious to the marksman's bullets as it was to salt water.

Designed primarily as a pipe line marker, the buoy may be used in any instance where a U. S. Coast Guard approved marker is needed. In many cases pilots of seaplanes have been able to land safely at night by using their landing lights on the highly reflective surfaces of the buoys.

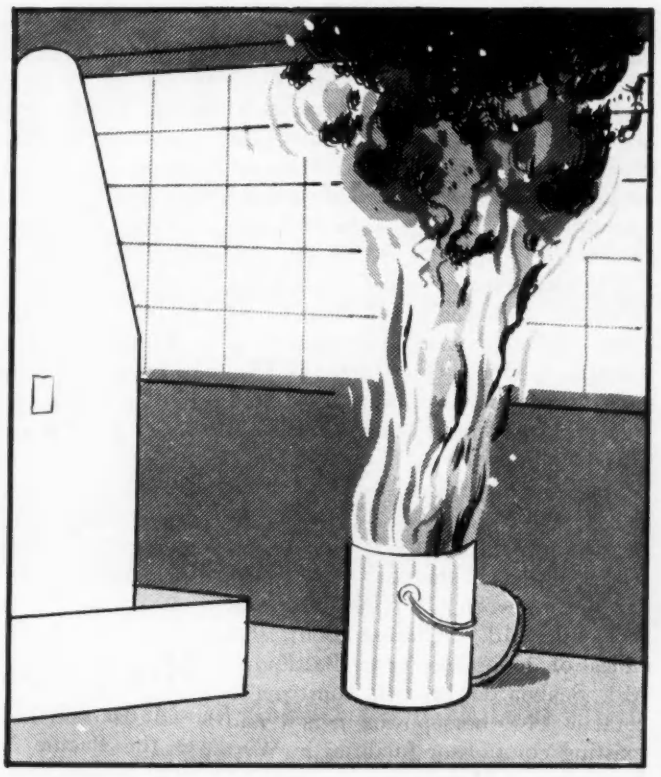
Two of the three types now manufactured are called channel markers. The type "C" or "Can" buoy has a reflective surface that is white by night and black by day. It marks the starboard side of the channel heading seaward. For marking the portside of the channel heading seaward is the "N" or "Nun" buoy and is red by night or day. The type "O" or "Obstruction," with standard, diamond shaped fins, has a reflective surface of alternate white and international orange bands.

Used extensively by companies laying pipe lines under water, the buoy may be anchored to the line as it is being laid or attached to a removable anchor. Other applications have been to mark municipal boundaries that extend beyond the shore line. Geophysical companies have also found it useful in marking proposed drilling or shooting sites. —**The End**

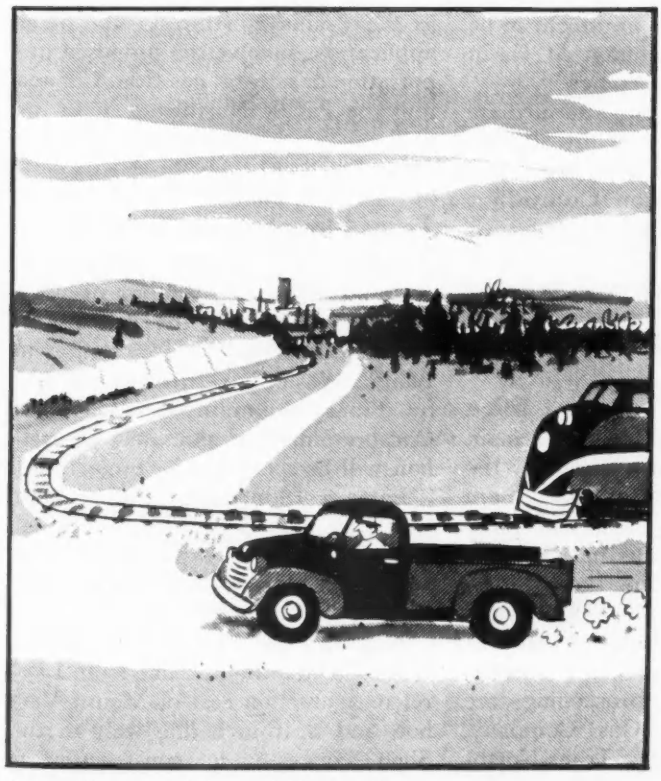
Perils of Pipeline Pete



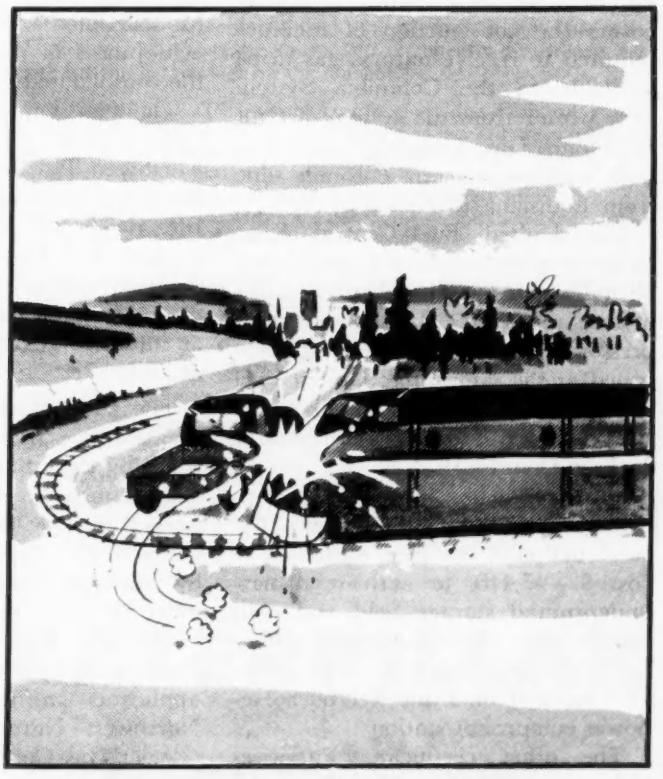
Oily rags . . . an open can . . .



. . . situation is out of hand



Streamliner comin' round the bend . . .



. . . Pete meets an untimely end

WHAT'S HAPPENING IN PIPE LINE CONSTRUCTION

By **MARY C. SPENCE,** WORLD OIL Staff

Columbia's $40 Million Projects OK'd

The FPC has issued certificates to six subsidiaries of The Columbia Gas System, Inc., for the construction of new pipe line facilities, having a total estimated cost of more than $40 million.

The certificates were issued to Manufacturers Light and Heat Company, Central Kentucky Natural Gas Company, Home Gas Company, Atlantic Seaboard Corporation, United Fuel Gas Company, and Ohio Fuel Gas Company.

Seaboard's project, estimated to cost about $14,619,300, includes approximately 116 miles of line paralleling sections of the company's existing line between Cobb, W. Va., and Rockville, Md., including about 10½ miles of loop line near Baltimore, Md. Seaboard also will construct a total of 4400 horsepower in new and existing compressor facilities in West Virginia and Maryland.

The certificate issued jointly to United Fuel and Central Kentucky covers the construction of facilities required to receive natural gas to be available to the Columbia System next winter from the system of Gulf Interstate Gas Company which is now constructing an 850-mile line from Louisiana to Kentucky.

The United Fuel-Central Kentucky project will cost an estimated $9 million. It includes about 59 miles of line and a 6000 horsepower compressor station. In another certificate issued at the same time, United Fuel was authorized to construct a 4400 horsepower compressor station at Jackson County, W. Va.

Two certificates also were issued to Manufacturers. One authorizes the construction of facilities, estimated to cost $3,747,446, to activate a new underground storage field and connect it with Manufacturers' existing facilities. This project includes about 72.3 miles of lines and a 1760 horsepower compressor station.

The other certificate authorizes eight separate jobs by Manufacturers, with a total estimated construction cost of $5,968,300. It includes a total of about 75 miles of pipe line and 4400 horsepower in compressor capacity.

Ohio Fuel Gas Company will construct a total of about 63 miles of pipe line, largely to replace existing facilities at a cost of $2,668,000.

Home Gas Company will build a total of approximately 50 miles of line in sections from Maine to Tioga, N. Y., and Deposit to Port Dickinson, N. Y. This project, estimated to cost $2,160,500, will complete the company's replacement of its multiple six-inch system of lines from Quackenbush Hill to Port Jervis, N. Y.

Colorado Interstate to Supply More Gas to Natural Pipeline

Colorado Interstate Gas Company has been authorized by the FPC to construct about 50 miles of 20-inch pipe line from the Morton County, Kansas, gas field to a point of connection with Natural Gas Pipeline Company of America, near Hooker, Okla.

The project, estimated to cost $3,999,703, will include a dehydration plant in Morton County, and a delivery meter station.

Natural will build facilities near Hooker, Okla., to enable it to receive the additional natural gas from Colorado Interstate. Estimated cost of Natural's construction is $665,000.

Northwest Gas Carrier to Be Named Soon

A decision as to who supplies gas to the Pacific Northwest will probably be reached this summer.

The FPC has ordered the intermediate decision procedure omitted and has scheduled an oral argument to be held June 1 in Washington, D. C., in the consolidated proceedings.

The omission of the intermediate decision was requested by Pacific Northwest Pipeline Corporation and Westcoast Transmission Company, Inc., two of the competing applicants in the case. The action means that the case will be decided directly by the Commission without the filing of an intermediate decision by a hearing examiner.

The FPC's order set April 26 as the deadline for the filing of main briefs by the applicants. Briefs by the staff counsel and all other parties are to be filed by May 11, and reply briefs by the applicants may be filed by May 26. The June 1 oral argument will be before the Commission.

In addition to Pacific Northwest Pipeline and Westcoast Transmission, applicants in the proceeding are Northwest Natural Gas Company, Glacier Gas Company, Trans-Northwest Gas, Inc., Northern Natural Gas Company and Colorado Interstate Gas Company.

Pacific Northwest is proposing to build a pipe line system extending from the southwestern United States to the Pacific Northwest. The other applications involve the proposed importation of natural gas from Canada into the Pacific Northwest, or in the case of Northern Natural, into the Midwest.

Trans Mountain Announces 20-inch Sumas-Laurel Line

Plans for the construction of a 20-inch pipe line from the British Columbia border just east of Sumas to Laurel, Wash., have been announced by Trans Mountain Oil Pipe Line Corporation. Approximately $2 million will be spent on the project.

Later a 16-inch line will be built west from Laurel to supply the General Petroleum Corporation's new 35,000-barrel-a-day refinery at Ferndale, Wash.

Proposals for 1955 include an extension of the 20-inch line from Laurel to a junction east of Mount Vernon and a 16-inch line west to the Shell refinery under construction at March's Point near Anacortes, Wash.

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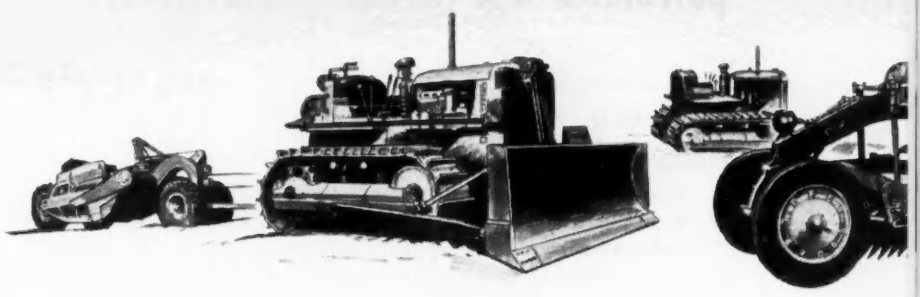

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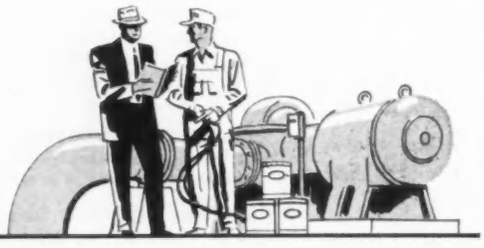

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Northern Natural Authorized To Complete Current Expansion

The FPC has authorized Northern Natural Gas Company to complete a proposed expansion of its pipe line system, already started, to enable it to deliver additional natural gas to existing customers and to supply several new customers in the Midwest beginning next winter.

The newly-authorized facilities include approximately 204 miles of main line pipe and 22,800 horsepower in main line compressor additions. The cost is estimated at $23,776,000. Additional branch line authorized for new service will cost an estimated $14,689,057.

The project is the final phase of an expansion program which will increase Northern's total system capacity by approximately 300 million cubic feet daily.

Great Lakes Pipe Line To Increase Capacity

Increased capacity for Great Lakes Pipe Line Company delivery terminals at Alexandria, Minn., Fargo and Grand Forks, N. D., will be provided by new lines to be constructed this summer.

A 12-inch line will be laid laterally from existing lines near Minneapolis westward to Willmar, Minn., where it will parallel the present 8-inch line to Alexandria. From there an eight-inch extension will be built along the route of an older six-inch line to Fargo.

A 12-inch line will also be laid this summer between Kansas City and Des Moines to supplement its 12-inch and two eight-inch lines. Capacity of the 12-inch line between Des Moines and Minneapolis will be increased by powering it with pump stations at 50-mile intervals instead of the present 100-mile spacing.

Oil Basin 230-Mile Line To Start Construction Soon

Construction of a 230-mile oil products pipe line from Billings to Glendive, Mont., will be started soon by Oil Basin Pipe Line Company.

Carter Oil Company, a subsidiary of Standard Oil Company (New Jersey) and the Farmers Union Central exchange, will use the line.

The project is expected to cost $5,350,000.

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Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

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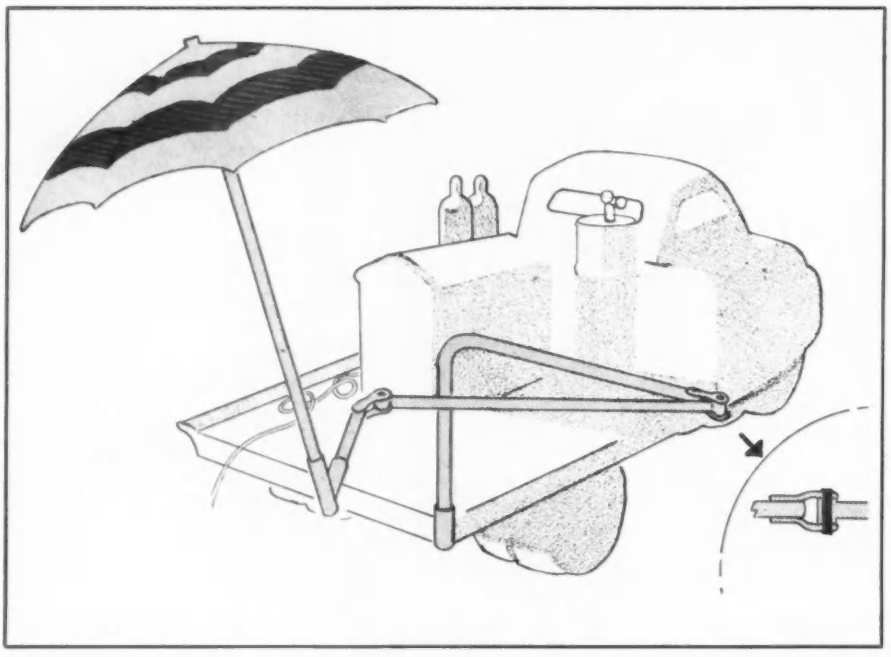
How to do it

PIPE LINE HINTS

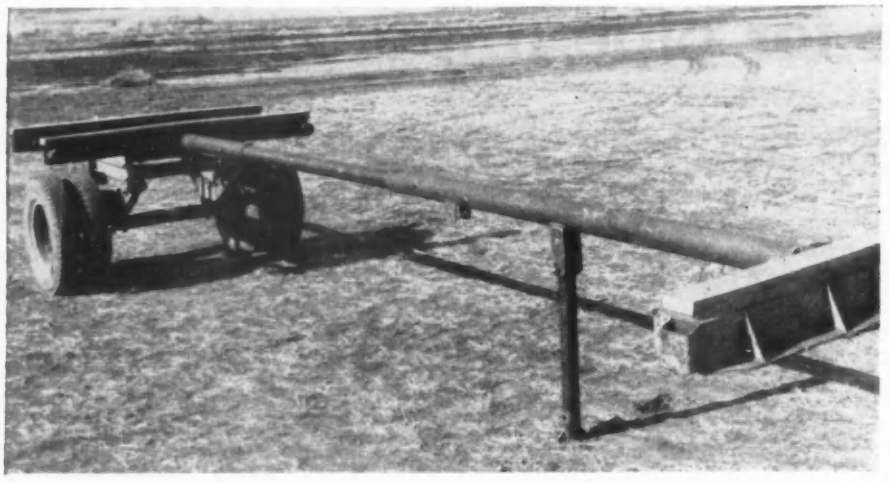
$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.



Umbrella Support Is Easily Adjusted

One welder has built an umbrella support combining flexibility with long reach and one that is easily collapsed and stored in the welding truck when not needed. The unit consists of three segments of 1½-inch pipe, hinge-connected with segments of salvaged rotary chain, installed to permit only horizontal arm movement. The first section, having an overall effective horizontal length of five feet, is bent through 90-degrees to enable mounting it in a socket welded to one corner of the welding truck. The second section is four feet long. The third, with an effective length of two feet, is fitted at the outer end with a set screw-equipped sleeve, the latter permitting rotation of the umbrella socket, to which it is welded, in only a vertical plane.

The welder can swing his umbrella through any angle desired, then set the sleeve with the hand-operated set screw. As work progresses, or as the sun mounts higher in the sky, he can extend or collapse the horizontal arms, or adjust the angle of the umbrella as desired. A minimum time is lost in moving the truck or shifting hoses and cables.



Stiff Leg Supports Trailer Pole Tongue

A hinged stiff leg as illustrated, located on the under side of the trailer coupling tongue, just back of the front bolster, supports the tongue in a horizontal position when the trailer is unloaded and unhitched from the truck.

The stiff leg, or supporting column is a piece of three-inch diameter pipe. A flat piece of steel welded to the bottom end and braced with triangular pieces of steel welded to the top of the steel foot and the sides of the stiff leg, forms a foot or base.

Make a hinge yoke from flat steel, four inches wide and one-half inch thick, with side members rounded on the projecting ends, and with a space between the side members one-eighth inch more than the outside diameter of the stiff leg. Weld this to the under side of the coupling tongue a short distance back of the front bolster. Holes large enough to permit a one-inch diameter steel pin to slip through, are cut in the side members 2½ inches below the under side of the trailer tongue. Similar holes are drilled through the sides of the stiff leg two inches below the top end.

Slip a one-inch diameter steel hinge pin through a hole in one side

of the yoke, through the holes in the top end of the leg and through the matching hole in the opposite side. It is then cut flush to the outer faces of the yoke's side members, and welded to the outer edges of the yoke holes.

A second set of one-inch holes are cut in the sides of the yoke, nine inches below the center of the hinge pin. Cut a set of holes in the stiff leg to match those in the yoke sides.

A one-inch diameter unthreaded bolt is slipped through these lower holes in the yoke and stiff leg, and secured in place by means of a spring safety clasp run through the cotter hole. This holds the stiff leg in a vertical position in line with the yoke frame, under the front end of the trailer tongue.

A small yoke welded to the under side of the coupling tongue has a lock bolt and safety clasp which holds the stiff leg in folded horizontal position when the trailer is hitched to the truck and ready to roll.

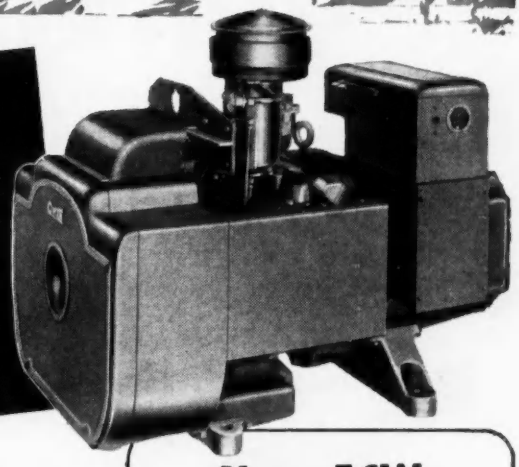
With the pipe trailer supported by the fifth wheel, the foot of the stiff leg is two or three inches off the ground.

Flexible Hose Reduces Exhaust System Hazards

To avoid ignition of gases that might be present when operating the gas engine powered shipping pump, some operators conduct exhaust

Forging Stronger Links in Microwave Relay

ONAN STANDBY ELECTRIC PLANTS



Microwave transmission is only as dependable as each of its relay links. If one repeater station cannot operate, messages do not get through.

To assure electric power for transmission, hundreds of microwave relay stations across the country are equipped with Onan Standby Electric Plants. When central station power is interrupted, the Onan plant starts automatically, supplies power for as long as the emergency lasts, then stops automatically. Controls are available to provide a time interval between power interruption and starting.

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If you have a problem in standby power for microwave radio, or any application, write our sales engineers. Onan Standby Electric Plants range from 1,000 to 50,000 watts.

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(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

New PITT CHEM Fills Big Gap in

First Enamel Formulated to Withstand High Line Temperatures on Pressure Side of Pumping Stations

HERE'S one of the most important new products ever developed for the protection of pipelines. It's Pitt Chem Hotline Enamel, a tar base coating specifically designed to protect more completely against the high temperatures now known to prevail on up to one-third of the length of most gas transmission lines.

Recent field tests indicate that temperatures as high as 180° F. are developed on the pressure side of gas pumping stations . . . with temperatures as high as 120°F. even 20 miles from the station.

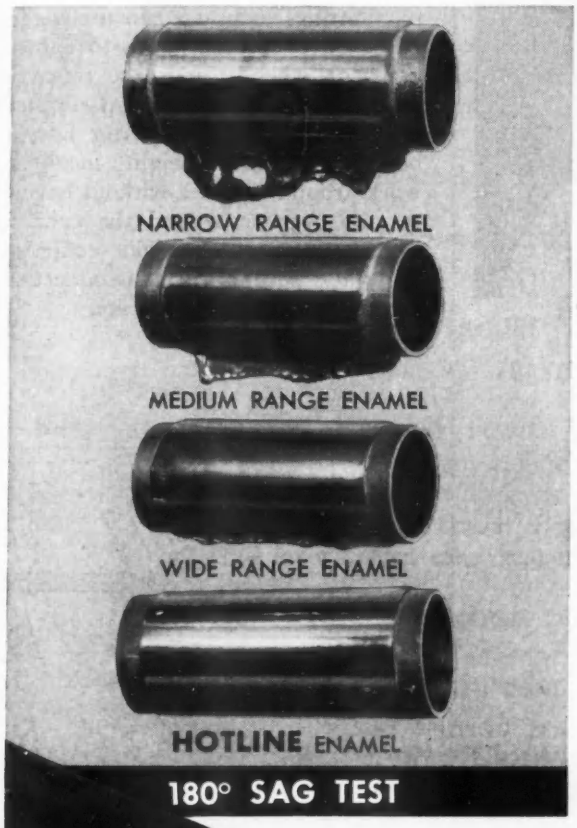
These temperatures can have several important effects on pipeline enamels. They can cause them to sag or flow off and expose the pipe, or to become so soft that soil stress and pressure can cause penetration of the enamel, resulting in apparent low coating resistance.

Even with these high temperature characteristics, the minimum softening point of Pitt Chem Hotline Enamel is only 240° F. The new enamel has less tendency to cold flow than any other coal tar coating. This quality, combined with its exceptional hardness and non-flow characteristics, indicates that a much higher resistance to soil and pressure stresses can be expected with Pitt Chem Hotline Enamel.

Pitt Chem Hotline Enamel is ideal for the following applications: On gas pipelines where service temperatures are above 100° F. In areas where excessive soil stress conditions prevail, or where the backfill and trench are rough, full of stones and rough objects which normally penetrate softer coatings. On all types of pipelines where ground temperatures are high most of the time.

For more information on this revolutionary advance in pipeline protection, call or write today for free Pitt Chem Hotline Enamel brochure..

HOTLINE Enamel Pipeline Protection

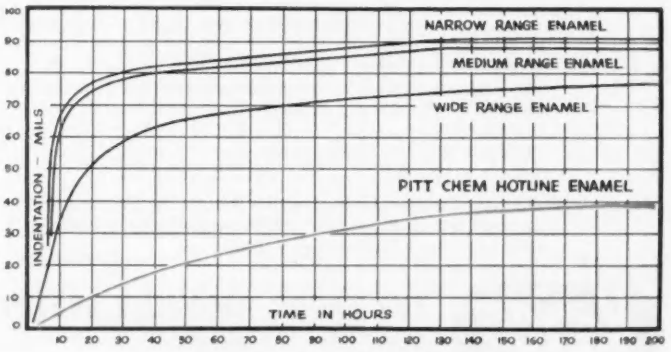


Proof of HOTLINE'S Resistance to sagging at high temperatures

These are actual pictures of sections of pipe coated with four different grades of pipeline enamel. These sections were exposed to 180° F. sag test temperatures. Note that only Pitt Chem Hotline Enamel resisted sagging.

Proof of HOTLINE'S Superior Resistance to soil stress damage

The chart below shows the degree of penetration that occurs when the three popular grades of enamel and Hotline are subjected to a pressure of five pounds psi. and tested over a period of 200 hours at 120° F. Pitt Chem Hotline Enamel's resistance to penetration is almost twice as great as any of the other three grades.



Cold Flow of Bituminous Coatings
Indentation by ½" D. Rod, 120° F., 5 psi Load

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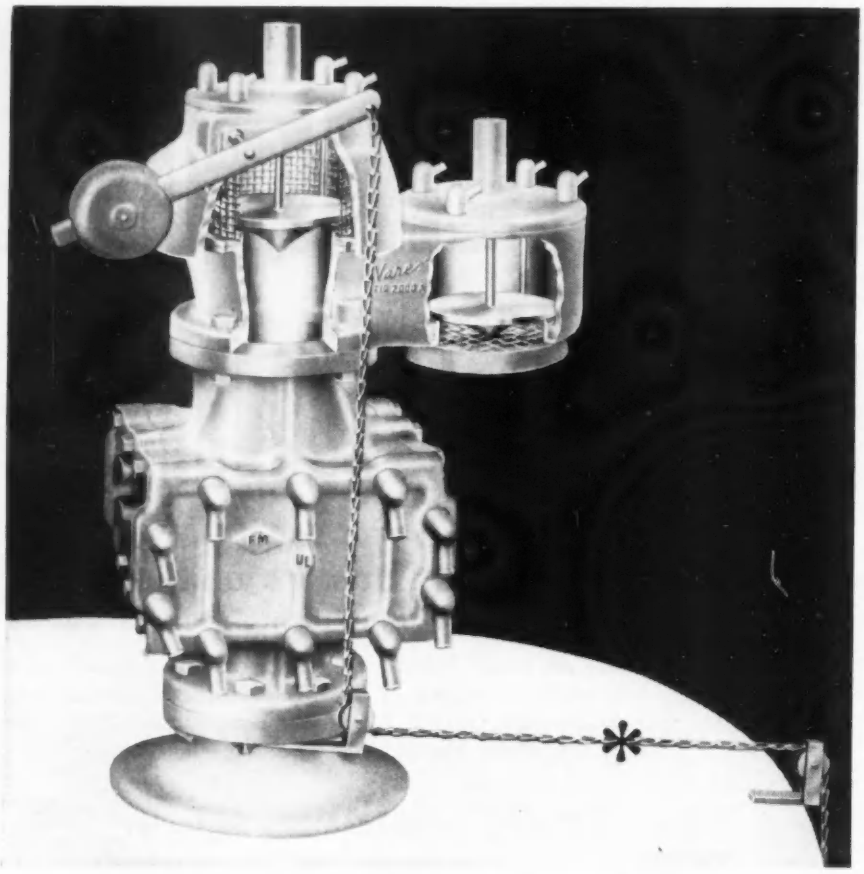

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* *Remote Control Flame Snuffer Sheave Brackets, Fig. 130 are optional at extra cost. This assembly is preferable where vent unit is set back from edge of tank.*

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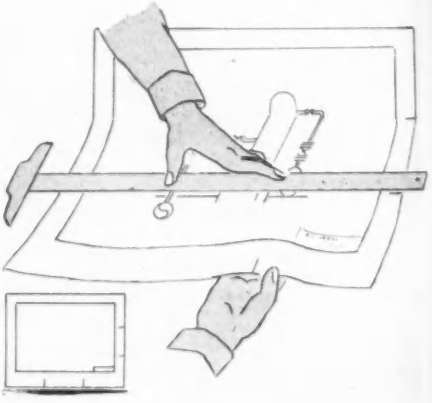
58-1

HINTS . . .

through a buried line, exhausting it finally at some point perhaps 20 to 30 feet away from the hazardous area. This is particularly desirable when high gravity crudes are being handled; where spillage or leakage may lead to the release of highly volatile gases.

To simplify connecting the engine into such a system, use a short length of flexible metal hose, connecting the engine exhaust stack and the fixed underground system as shown. Such a method permits rigging the installation in the least possible time and avoids problems arising when the exhaust connection is made with ordinary fittings such as when the engine is moved back on its rails to tighten belts, or when it must be removed for repairs. With the present elevated position of the connecting line, it being above head height, men can work around the area without having to step over or around the exhaust line. A union in the rigid section of the stack permits easy disconnecting of the flexible exhaust section.



Tracing Cloth Aids In Folding Drawings

An important task associated with the issue of drawings required for construction of a pipe line project is their folding. Often the drawings are folded in a standard method, but "eye-balling it in" is often inaccurate, causing drawings to be refolded again and again.

Four small cross marks on the margin of the tracing coth can simplify this task. The marks will reproduce on the prints and will save minutes for more important jobs.

This new heavy-duty Allis-Chalmers HD-9 Tractor and side boom provides new strength, power and exceptional lifting capacity to handle a wide range of pipeline jobs. With its speed and high maneuverability, this combination can save money on jobs now handled by bigger, more expensive machines. It is the right answer for construction of feeder, distribution and smaller inch cross-country lines — ideal size on the big inch jobs for stringing, handling pipe joints for welding crews and bending machines — economically handles maintenance, repair and take-up work on existing gas, crude oil and product lines.

A Pipeliner's Tractor

The HD-9 answers the pipeliner's demands for performance, simple servicing, dependability, operating ease. Just by shifting a single lever, operator can go from any of the six forward speeds to any of the three reverses. This, plus easy handling boom controls, direct electric starting on diesel fuel, booster steering, self-energizing brakes and adjustable seats, speeds up the job — work is done faster, more safely, and at lower cost.

Extra long track and excellent balance give the HD-9 the stability and flotation for operation in mud and tough going. Seven truck wheels for each track mean smooth, easy rolling. Double reduction final drive and smooth, clean bottom construction provide extra clearance which permits skimming over obstacles that might otherwise "hang up" a tractor.

Like all Allis-Chalmers tractors, the HD-9 is a cinch to service. Truck wheels, support rollers and front idlers require lubrication only once every 1,000 hours. No lube points under tractor. Unit construction — major assemblies are removable without disturbing companion groups.

New Heavy-duty Tractomotive Side Boom

FEATURES TWO NEW MAJOR DEVELOPMENTS

FRONT MOUNTED POWER TAKE-OFF — Power is taken from engine crankshaft — permits side boom to work independently of tractor master clutch. Back of tractor is free for winch or other rear-mounted equipment.

DUAL CLUTCH SIDE BOOM CONTROL — one for raise, the other for lower. By merely pulling one lever, operator can switch from "raise" through "neutral" to "power down" on either load or boom lines—no gear shifting necessary. Operator can act fast in an emergency — an important safety factor. Other features include:

- **CONVENIENT CONTROLS — easy operating, positive, conveniently located.**
- **SURE-GRIPPING BRAKES — exclusive, internal expanding brakes provide positive control of load and boom line drums. Completely enclosed from dirt and moisture.**
- **SAFETY-LINK EXTENDABLE COUNTERWEIGHTS — controlled hydraulically and mounted high for maximum clearance. Safety linkage prevents accidental dropping.**
- **QUICK-ON, QUICK-OFF SECTIONAL FRAMES — pin-connected for quick installation and removal . . . makes it easy to ship or service tractor.**
- **HUSKY, 15-FT. BOX SECTION BOOM — automatic clutch throw-out prevents bending of boom against boom stop.**
- **SIMPLIFIED TRANSMISSION — 2 forward and 2 reverse speeds for load line and boom line.**
- **OPERATOR AND CREW SAFETY FEATURES — sure-gripping, weatherproof brakes . . . big, husky brake levers, ratchets, and linkage . . . positive locking winch controls . . . massive winch drum jaw clutches . . . drop-proof counterweight linkage.**

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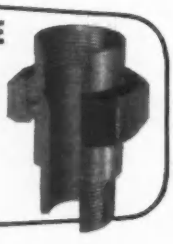

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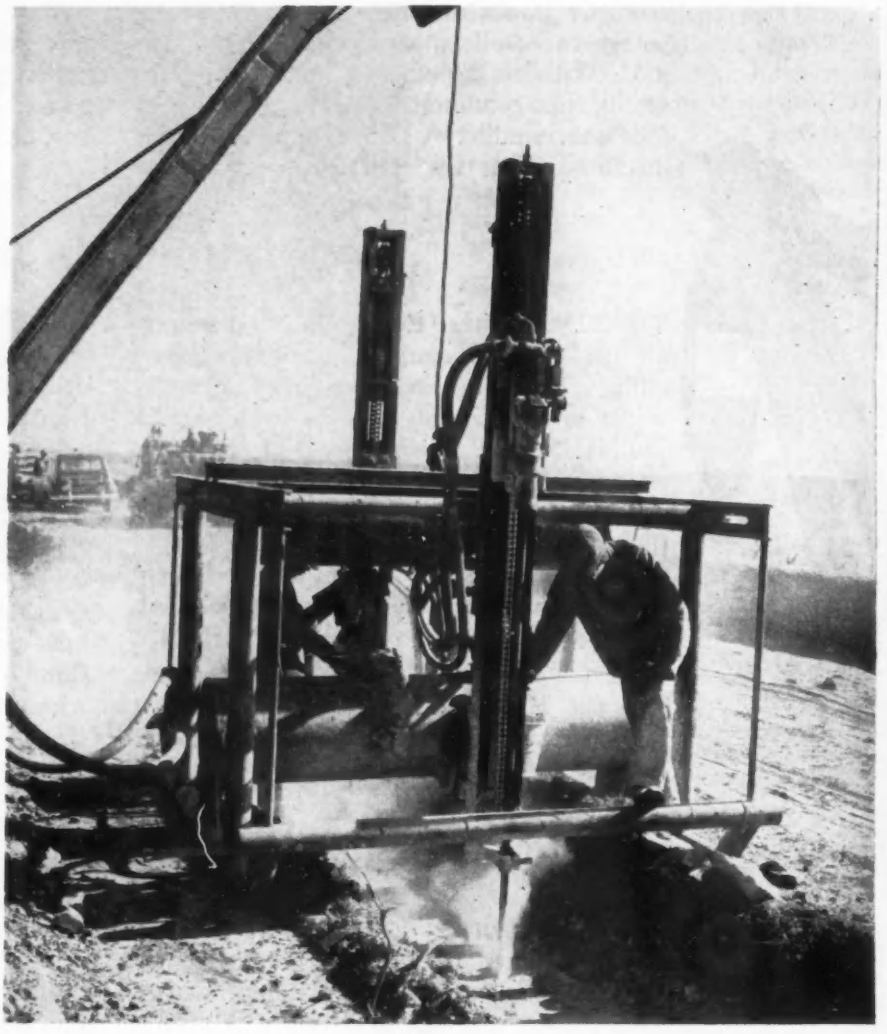

—"The Explosives Engineer," March-April, 1953.

Frame-Support for Drill Aids Operation

The drill carriage shown here was devised by the Sira-McKenzie Construction Company, for drilling the sub surface rock of West Texas. The carriage supports the drills in such a way that vibration is minimized, and the drills cannot change position once the hole is started. In addition, it has volume chambers which insure an ample supply of air, once the hole is started.

Moreover, it makes possible the drilling of a staggered row of holes with irregular spacings, or a straight line of holes with uniform spacings, to conform with the variations in rock formations along the ditch line.

The carriage is made of four-inch pipe and "I" beam as shown. Note that the bottom runners are bent upward to form a skid for easy transportation. The volume chambers are made of 12-inch pipe, bull-plugged at the end. The drills are clamped to the frame with "U" bolts.

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The Land of Nietu*

A prophecy made in 1930: The Russians will use foreign technical aid until they can carry out their plans. Then they will turn upon the very nations from which they are receiving credit and assistance.

By ROY E. LEIGH

WE ARE TOLD, and it is plain to be seen, that the Soviet plan calls for the ultimate abolition of family life. Marriage and domestic life are slated to go, along with religion and other time honored institutions. Not all churches of Russia have been closed; and it is still possible to arrange for church weddings, if the participants be so unwise as to insist. No definite legal or official obstacles will be placed in their way to the altar; but later they may find themselves expelled from their respective trade unions, minus the all-important bread card, and subject to other subtle and devious discriminations.

Civil marriages, as well as divorces, are matters of simple formality. One may be married in five minutes and divorced ten minutes later. Divorces may be secured, either by the husband or wife, in a few minutes time, with or without the knowledge or consent of the other, upon payment of 50 kopecks, worth 2 cents or "two bits," depending upon what value one attaches to the ruble.

An official postcard, directed to the last known address of the divorced spouse, notifies him or her that he or she has been jilted. Either the mother or the father may be required to pay alimony, depending upon which is left with the custody of the children. The responsibility of the woman is always and every where exactly the same as that of the man; there is no difference between the sexes in any department of Communistic life.

Women being regarded as economically independent, childless grass-widows are not entitled to alimony; but a father, left with the custody of a child, may receive alimony from the mother. On the other hand, an unwed mother is entitled to receive certain regular payments from the father of her child. She simply designates the father to certain officials; and the state enforces the payment of stipulated sums calculated to be sufficient for the support of the infant during the first few months of its life. Later, these payments cease.

While the Soviet law makes provision for civil marriage, the marriage custom is nevertheless falling into disuse as a result of the campaigns directed against religion and family life. No disgrace attaches to adultery, concubinage, or illegitimate birth. Men and women not only may but actually do maintain more or less regular relationships with two or three or more members of the opposite sex at the same time. We are told that, in many cases, monogamous unions endure for years; but, in others, men and women simply take up with each other like animals, live together for a day, a

* Literally translated—"The Land of Nothing."

Part 2

Here is the second and final chapter of a manuscript written 23 years ago by Roy E. Leigh, then International Editor of The Oil Weekly, now WORLD OIL. (See WORLD OIL, 1954, April issue for Part 1.) It was written in Tehran, Iran, immediately after Leigh reached Tehran following six months spent in Russia.

The manuscript was withheld from publication at the time because of the fear that Communistic rulers would think that Leigh had received his impressions from Russian oil men with whom he talked, or American technical experts who were in Russia at that time employed to help the Russians inject American know-how into the oil business.

As a matter of fact, Leigh, a keen observer, gained his impressions from what he saw first hand, as well as information on policies received from the Communistic spokesmen themselves, and he formed his own conclusions.

Many of the passages, written 23 years ago, are italicized because they represent either prophecies made by Leigh, or because of their present-day importance.

Leigh was for several years International Editor of The Oil Weekly, spending the first two years on a field-by-field trip around the world, and his remaining time in Oil Weekly's New York office. He resigned to enter the oil business very successfully in Texas. He lives in Austin and occasionally makes special trips on assignment for WORLD OIL—"just for the fun of it."

RAY L. DUDLEY
Publisher, WORLD OIL

The Soviets Said . . .

In 1930 the Russian officials said the cottages above were occupied by oil field workers in the Grozny District. The photo below was given to Author Leigh as an example of living conditions in the oil fields in pre-revolutionary times.

'The next generation of Russians having grown up during periods of war, revolution, oppression and bloodshed . . . will be wilder than cannibals . . . recognizing responsibility to neither God nor man.'

week, or a year, as the whim suits them, and then separate to find new companions, each in unending series.

Birth control is an accepted and recognized practice in Soviet Russia. A woman who finds herself in pregnancy may either demand support from the father of her unborn child; or she may go to a state physician and submit to an abortion, as she chooses. In the latter case, no questions are asked concerning her marital status or the identity of the father of her child.

Despite such measures, the birth rate in Russia is increasing by leaps and bounds. Birth control is proving an inadequate counter-balance to the promiscuous relations of men and women, youths and maidens. *The Russian people are breeding like guinea pigs.*

As a result of the breakdown of family and religious life, and the removal of the stigma from casual sexual relationships, the fertile period of Russian women has practically been doubled. Little girls begin bearing children immediately after puberty, instead of waiting until maturity as in former times. The annual birth rate in Russia now averages 23 per 1000 as compared to 1.3 per 1000 in France, and 6.4 per 1000 in England. Even the Italians, hitherto regarded as a very fertile people, have a birth rate which approximates only 45 percent of that of the Russians. With such figures,[1] we sustain the accuracy of our comparison with guinea pigs.

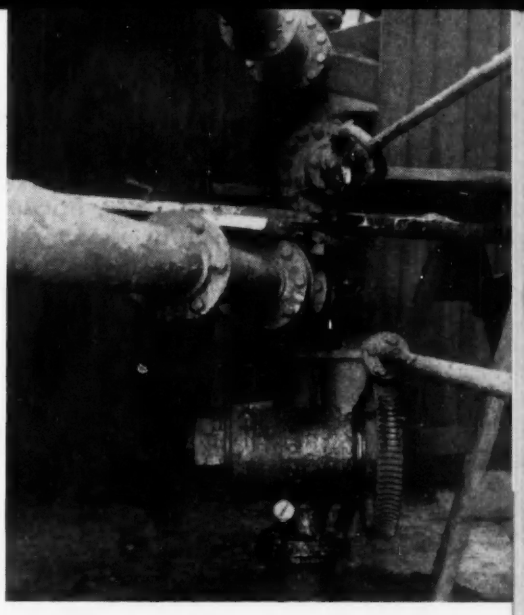
We were given to understand that, in the final development of the Communistic scheme, *family life will disappear entirely.* Individuals will be assigned to separate rooms in communal lodging houses, where they will eat in common dining rooms, and receive and entertain their friends in communal social halls.

In fact, a beginning has already been made in the construction and organization of such institutions. Obviously, there will be no place for children in dormitories thus organized for adult occupation, the plan being that *children will be turned over to the state as soon as hatched.* Children will become the responsibility of the state, to be cared for and educated in state institutions. *By this means, it is believed that complete unity of thought will be achieved among Soviet peoples, as only accepted theories of Communism will be taught in state kindergartens and schools.*

Meanwhile, like everything else in Russia, such hostels and educational facilities exist chiefly on paper; so that, for the time at least, the final offensive against family life must be deferred, or, rather, it cannot be attacked so aggressively as in the case of religion and other institutions regarded as inimical to the progress of socialism. Of course, there has already been a great dissolution of family life, under the influence of constant Soviet propaganda. Only those families held together by the strongest ties of loyalty and affection still endure; and, for them, it is the practice of the authorities to provide small two-room and three-room apartments. The construction of separate bungalows has been discontinued.

Pending the attainment of the Communistic ideal, nurseries and kindergartens intended for the care and education of Soviet youth have not yet been established, except in a very small way for exhibition to foreign visitors; and, therefore, children from families that have been broken up under the first onslaughts against family life have simply been turned into the streets, to live or die by thievery and beggary. The first great army of wild children, the products of war and famine about which the outside world has heard so much, are now approaching maturity; but their places in the gutters are being taken by fresh recruits, products of casual relationships and children of disbanded families.

The next generation of Russians, having grown up under such conditions and during periods of war, revolution, famine, oppression, and bloodshed, will be wilder than cannibals, recognizing no responsibility either to God or man. If they are able to organize their forces and resources, they will certainly become a menace to civilization. [Author's note: This "next generation" has now come to maturity (1954)!] It is not to be expected, however, that such people will be so able to organize and regulate their own lives as to enable them to wage war successfully.



CHRISTMAS TREE—the type used on wells in the Baku District in 1930.

Internal Propaganda. Free speech and freedom of the press do not exist in modern Russia any more than in pre-revolutionary times. *The only printed material available to the people is the propaganda put out by the Bolshevik rulers. Never in history was there a people so deluded.*

Bad as he knows his own condition to be, the Russian proletarian is taught to believe that it is better than conditions in the capitalistic world. He believes that there is famine in America and Western Europe; that people are starving by the hundreds and thousands in such cities as New York and London.

History has been rewritten and reshaped to suit the ends of Communistic propaganda. The Russian student learns the details of battles and maneuvers of a great war about which students in other countries have never heard—a war in which the victorious forces of Communism defeated the

combined armies of America, Britain and Japan. The small American force which held Archangel for a time during the latter years of the World War, and the equally small British force which occupied Baku, have been expanded into powerful armies acting in concert with the Japanese and advancing from the north, south, and east for the subjugation of Russia. Their defeat and withdrawal are recorded as triumphs of the mighty Red Army.

The average peasant and industrial worker believes that his country is even now in a state of war with the capitalistic powers. (Author's note: war psychology.)

In every shop, office, and lodging house, and wherever people congregate, is a room or corner decorated in Red banners and known as "Lenin's Corner," or "Culture Corner." In these corners are displayed posters and literature extolling the virtues of communism and condemning the vices of capitalism. Lenin's bust or photograph is always to be found, as in every occupied room, office, or shop throughout Russia. The veneration of Lenin being compulsory, in its outward aspects at least, it is impossible to judge the depth and sincerity of the respect and regard which the people hold for the man who liberated them from the bonds of absolute monarchy; but it is noticeable that Lenin's picture occupies the spaces formerly held by Icons and tokens of a religious nature. To outward appearances, at least, the cult of Leninism has been developed with all the fervor of religion.

The chief subject to which those Lenin Corners are devoted, however, is the culture of the sword. *The people are being prepared for war with the same painstaking care that characterized the efforts of the last Kaiser.* Everywhere one sees posters devoted to the nomenclature, mechanism, and care of the machine gun and military rifle; and to plans and specifications showing the construction of trenches and fortifications. *One would think the country already at war.* (Author's note: In 1930, the outside world thought itself at peace!)

A favorite poster of this series shows, at first glance, a peaceful wooded scene, with green trees and shrubbery as the chief features of the landscape. One may lift a hinged flap and find that beneath this pastoral surface are concealed dugouts and trenches filled with alert Red soldiers. A second flap is raised to reveal the details of the constructions of those dugouts, with exact plans, measurements and specifications.

Another favorite poster shows a stalwart Red soldier standing erect and unafraid, defending himself with his rifle and bayonet against the heavy artillery of the capitalistic world.

One may see other posters showing heroic Russian and Asiatic soldiers and working men advancing, with Red flags flying, upon cowering figures representative of the British Empire, the Fascist State, the French Republic, and the Church. Ramsey MacDonald is often shown in ridiculous caricature. John Bull is depicted as a rotund figure, wringing his hands in agony of fear and despair. Strange to say that, while the newspapers publish cartoons derogatory to the capitalistic features of American life, *we did not see one poster in which America was included in the same despicable category with the nations of Western Europe.*

Thus, we have the strange situation in which the American nation, which has never recognized the Soviet state, is treated with greater consideration than the British Empire, which has renewed diplomatic relations with Moscow.

The reason, of course, is not hard to find—American recognition is still to be gained. American credit and American engineering talent and technical assistance must be had for the reconstruction of the country and for the carrying out of the Five Year Plan. Americans have been chosen for this role, not alone because of their technical and industrial leadership, but also because of their lack of interest in European political affairs. It is said that Western Europeans who go to Russia are wont to plunge immediately into matters of internal politics; whereas Americans are more likely to remain aloof, refusing to concern themselves with matters which seem so remote from their own country.

American engineers and technical experts have been brought into the country by the thousands to act in directing or advisory capacities in connection with the rehabilitation of the railways, mines, oil fields, agriculture, and metallurgical and manufacturing industries. These Americans occupy very peculiar positions. They are set upon a plane above and apart from that of their Russian associates. They are above the law of the land and the power of the police. It is commonly understood that the worst punishment which can be meted out to them, regardless of what ever crime they may commit, is deportation.

Americans who enter Russia do so at their own risk, without hope of consular or diplomatic aid or protection. That, so far as we know, there have been no very painful incidents nor instances of imprisonment of American citizens speaks well for the forbearance and restraint of both sides —no less for the Russian wielders of autocratic power than for the large numbers of Americans temporarily resident in their midst.

What will be the position of these sojourning Americans if some tension should develop between the Soviet Union and the United States? If, for example, the Amtorg Trading Corporation should be expelled from America, as Arcos, Ltd., was expelled from England?

Some Americans, to their sorrow, have been persuaded to accept payment of portions of their salaries in rubles, which they now find that they can neither spend nor export; but the most of them receive all or part of their salaries in American gold, deposited in the United States. They are given special food cards which entitle them to meats, fruits, fresh vegetables, and other delicacies denied to the rank and file of Russian citizenry and reserved unto the ranking commissars, even in some cases including white flour, the rarest delicacy in all the Russias.

We do not mean to imply that the sojourning American enjoys such items on every menu, but only at such intervals as the market affords them. It must be said, on behalf of Soviet officialdom, that everything possible under chaotic conditions, and everything conceivable to the minds of a people who have not even dreamed of such luxuries as those to which the

THE NEW Cameron FLOW CONTROLLER

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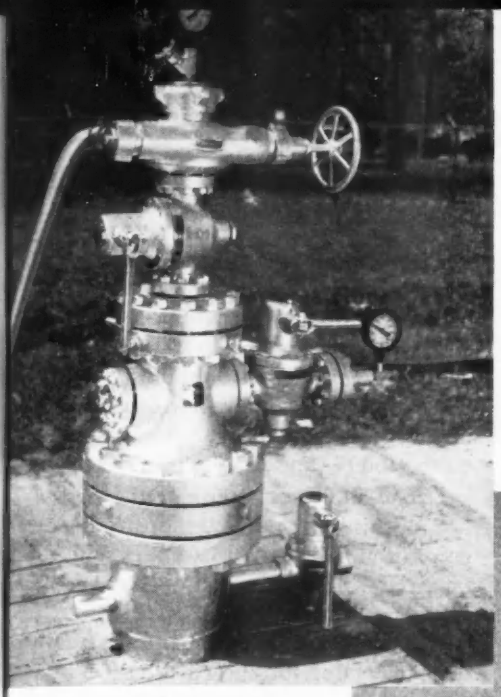
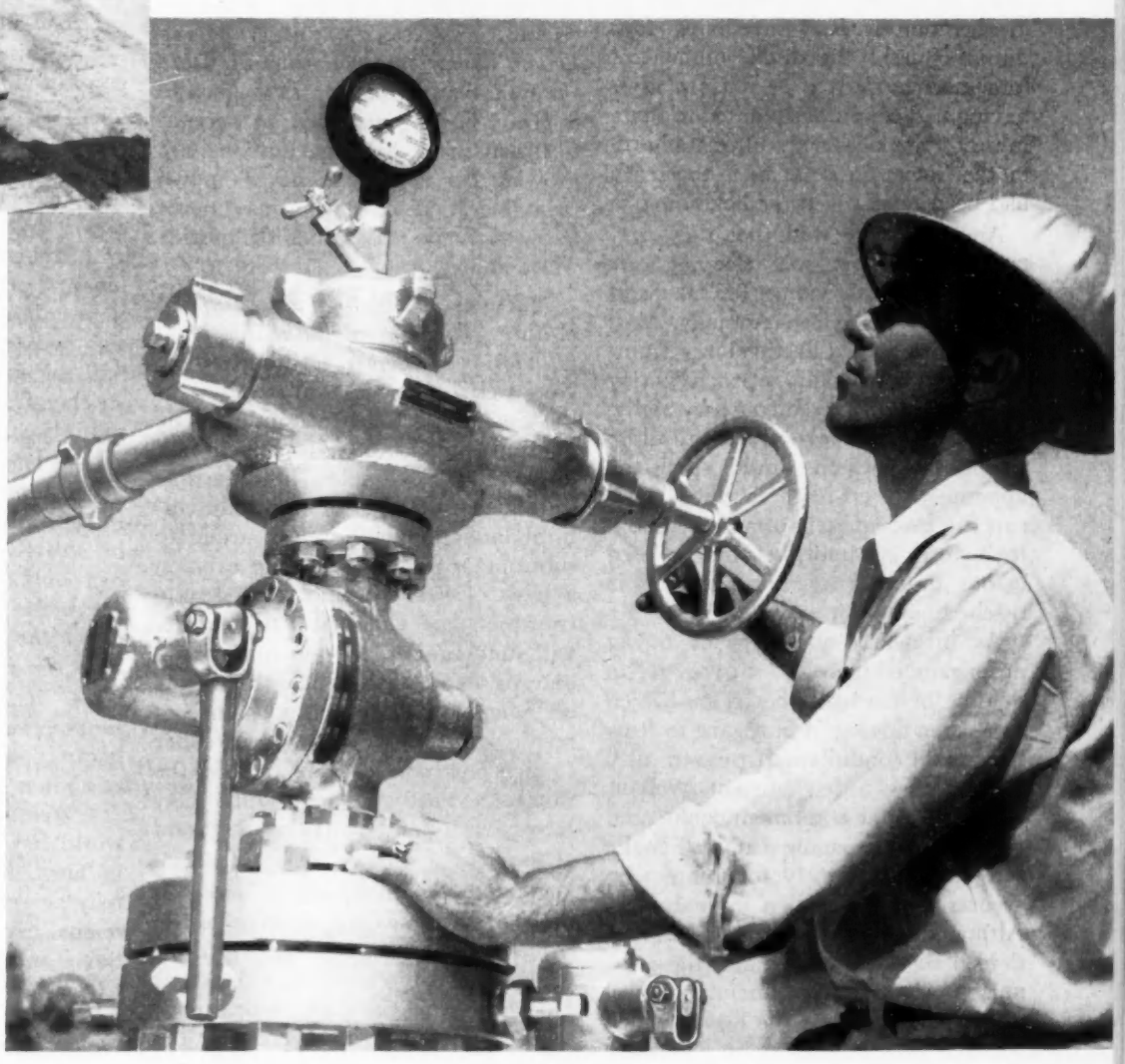
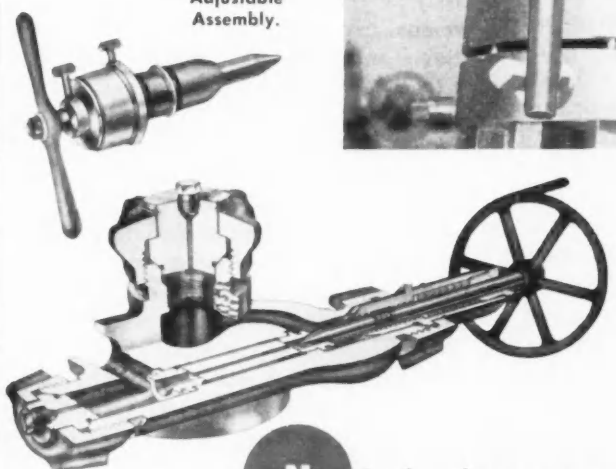


A Cameron Christmas Tree equipped with Flow Controller.



- Replaces conventional tee, choke, wing valve, top cap and their connections.
- Readily interchangeable with popular Cameron Type "H" Production Chokes.
- Easily convertible to positive or adjustable choke, or a combination of both.
- Reduces weight of tree without sacrificing safety.

Adjustable Assembly.



Note in the above cross-section view that flow may be shut off by means of a replaceable seat and valve assembly. Downstream from the valve a positive flow bean (shown in position) or an adjustable choke assembly (shown removed) may be used. To change the flow bean it is only necessary to close the valve element, unscrew the bonnet nut, and then unscrew the bean retainer which carries the flow bean in a sleeve. The positive choke may be converted into a combination positive and adjustable by substituting the adjustable choke assembly for the blanking plug. If an adjustable choke alone is desired it may be obtained by removing the positive flow bean and re-installing the bean retainer which serves as a seat for the adjustable needle.

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American is accustomed as a matter of daily routine, has been done to please the foreigners whose services are so essential to the execution of the great Five Year Plan.

That the results fall far short of expectations is not so much the fault of the Russians at home as of their employing agents in America, who must know better but who persist in misrepresenting Russian living conditions. Surely, the disillusionment of foreigners arriving in Russia after having had conditions painted to them in rosy terms does more ultimate harm to the Soviet cause than if the truth had been revealed in the beginning.

Americans are told that they may travel in comfort, with sleeping cars and dining cars rivaling Pullman and Fred Harvey services. Actually, most of them are forced to travel in vermin-infested cars in which a bench by day becomes an uncovered couch by night; and to eat in evil-smelling, filthy dining cars which would spoil the appetite of a self-respecting hog. Such cars are inadequately provisioned, and their stores inevitably become depleted before the end of the journey is reached.

As in nearly all forms of Soviet propaganda, there is, however, a shadow of truth in the claims which have been advanced in regard to Russian travel conditions. If pressed, they can produce a few ancient Wagons Lit, relics of the equipment confiscated from the Compagnie Internationale; but one is extremely fortunate who secures accommodation in such cars. Although we enjoyed many facilities denied the local citizen and the ordinary tourist, we were forced to travel across Russia in cars the like of which we hope never to see again. Not once were we able to secure reservations in the first class sleeping cars of which so much boast is made.

Sex has also been abolished in Russia, along with other time-honored institutions. There is no difference between men and women, either in social, industrial or economic life. Men and women are assigned indiscriminately to share two- and four-berth sleeping-car compartments, steamship cabins and hotel rooms.

Future Doubtful. We realize that our friends at home will insist upon a definite opinion regarding the future of the Soviet state and prospects for success of the Five Year Plan, *which means so much to America in the way of trade at present and in the way of competition in future.* We wish that we could be excused from the necessity of formulating such an opinion.

Slavic peoples are not to be judged by any standards developed by Anglo-Saxons. *The Russians, never having known liberty since the time of Ruric the Red, may ultimately settle down to a prison-like regimen and an animal-like existence.* New generations are growing up who have never known palatable food and who may never know of the luxuries which the outside world enjoys.

It is even possible that a new type of industry may be established upon a foundation of slavery. (Author's note: Note well.) The material resources of the Soviet domain are limitless. The Russian millions, operating their rich mines, fertile oil fields, inexhaustible forests, and vast pastoral and agricultural lands stretching from arctic to subtropic regions may be able, even on a basis of low efficiency and despite confusion and chaos, still to compete with unorganized private commercial enterprise. The time is only three years off when Russia expects to gain economic independence, to cease her foreign purchases entirely, to enter the ranks of exporting nations, and to play havoc with the capitalistic world generally.

The Communists make no secret of their hostility toward existing orders throughout the world. The overthrow of King George and of President Hoover occupies as prominent a position on their present agenda as did the overthrow of Tsar Nicolas in the beginning.

The apprehensions of the outside world have heretofore been limited to the threats of Soviet propaganda and of military action by the Red army. *A new weapon has been forged,* however, which is intended to be stronger and more effective than either of these. *It is the economic weapon.* The resources of industry have for the first time in history been placed at the disposal of political cranks.

We have considered this matter at some length; and we must confess that *we see some prospect for the partial success of this new weapon.* Of course, our investigations have been made at very close range; and it may well have happened that we have been influenced to some degree by the boastful claims of confident Communists. Perhaps the whole problem will dwindle in perspective when again we set foot on the soil of sane America.

Let us, however, consider the position of this great politico-industrial organization if/when all its mines, mills, factories, railways, and ships have been completed and placed in operation.

Everything needed, not only for internal use but for the carrying on of export trade as well will be produced within the country; and *at no cost for labor.* Labor is the most expensive item entering into the cost of production by private commercial enterprise; but this item has been, or may be, stricken from the accounts of the communistic industrial state.

The laborer is in the same position as the slave and the industrial state is in the same position as the slave-owner of old. As the plantation owner fed and clothed his slaves from the products of his farm, paying them no wages above the cost of their keep, so, also, does the industrial state feed and clothe its slaves, in equally scanty fashion, allowing them no comforts, luxuries, and liberties above the bare minimum needed to sustain life.

Ultimately, if/when the whole world has been conquered for Communism, the rigors of this discipline may be relaxed; but, until then, it is to be expected that the profits of Soviet industry, if any, will be devoted to propaganda and interference, hidden and open, in the affairs of other nations. We were reminded in this connection of the badge or symbol of Communism—the hammer, the scythe, and the five-pointed star. The points of this star are representative of the five continents, Europe, Asia, Africa, South America, and *North America!* According to the claims of the Third Internationale, North America is to come under its domination equally with Russian Europe and Russian Asia.*

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* Some people may have considered this far-fetched in 1930.

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fuel, every class of lumber and building materials, and every commodity which humanity requires can be produced in Russia in tremendous quantities. Russia today lacks only brainpower. Manpower she has in abundance. Any other civilized people on earth would long ago have made of Russia a strong self-supporting nation. It is not impossible that Soviet Russia can be made self-supporting, especially with the aid and guidance of foreign technical talent.

We must remember that the pyramids, likewise tremendous tasks in their day, were also built with slave labor. The pyramids, however, unlike the complicated socialized industrial state envisaged as the Communistic ideal, required no maintenance and no operating genius to keep them in existence after their completion. American engineering firms have undertaken construction contracts which, barring the possibility of famine, practically *ensure the erection and completion of the physical facilities* encompassed in the Five Year Plan. Railways, factories, refineries, mills, mines, and other industrial units have been projected or constructed by the hundreds and thousands with foreign technical aid. But will the Russians be able to operate and maintain these great machines after they are completed and turned over to them?

Russia's engineers and educated men generally have been murdered, imprisoned and driven into exile. Speaking from first-hand personal experience, we have seen exiled Russian petroleum engineers everywhere—in England, Germany, Roumania, France, America, Venezuela, Colombia, Peru, Bolivia, and Argentina. Those few who remain have been cowed into attitudes of helplessness, as we also saw first-hand. Poor creatures. Many of them are also marked for extinction!

Of course, the Soviets expect to utilize foreign technical aid only temporarily during the transition period. *Then, as surely as they are able to carry out their plans, they will turn upon the very nations from whose citizens, corporate and private, they are now receiving credit and assistance.*

Meanwhile, their plan is to develop engineers and technical men of a new type, recruited from proletarian classes and trained to assume the burdens now resting chiefly upon foreign shoulders. If capable, thinking men and women, possessing creative talent and organizing genius, can be developed from Russian peasant stock within the time limits imposed by the exigencies of the situation, we shall be very surprised. It might be done in generations of time, but not in the few short years allotted.

Counter-revolution? Regarding the political outlook, *we anticipate no counter-revolution,* no outburst of popular resentment such as would follow—rather, as would long ago have occurred—were any Anglo-Saxon people to be subjected to such cruelties and conditions as those in Russia today. Thinking Russian patriots, of whom there are a few remaining, even among those who have outwardly or temporarily accepted Bolshevism, permit themselves to hope that the Russia Revolution will follow the course of the French upheaval; that the Reign of Terror may be followed by a gradual return to normal conditions.

No one expects any precipitous action. *The Russian masses are too thoroughly cowed for that.* A weapon has been used against them which has never been forged in our country and which is unknown in our history—the secret police.

Secret police power is as much a weapon of Bolshevism as ever it was of Tsardom. The psychological power of the Soviet secret police is far greater than its actual physical power, however great that may be. Every workshop, every office, every lodging house, and every community is honeycombed with detectives, spies, and informers, spying on the populace and spying on each other. No one dares to open his mouth. His bench-mate, his room-mate, his best friend, or even his wife, pro tem, may be an agent of the secret, unseen power. Under such conditions, *opposition leadership cannot raise its head.*

A crucial test, however, will come on or about Sept. 30, 1933, at the end of the Five Year Plan, on which date the proletarian workman expects to reap the reward of weary years of denial, to inherit the earth and the fruits thereof, to be master of the world. If the rigors of diet and discipline are not ameliorated on that date, the disappointment of the populace may transcend all bounds of fear and caution. Precipitous action may occur at that time, but *we do not expect it.*

We think that another program, possibly one of war, will be offered with the same evangelistic fervor just prior to the expiration of the Five Year Plan.

Many people believe that when the Bolsheviki foresee the ultimate end of their regime they will plunge their country into war so that the voice of opposition may be drowned in the cry of patriotism. Opponents may not be lacking. The Soviet standing army is greater than the American Army of 1918, itself the greatest in our history.

The majority of people cognizant of Russian affairs, however, expect that the country will submit to a dictatorship at some time not far distant. Stalin, a master political strategist, is definitely emerging from the squirming mass of leaders, near-leaders, would-be leaders, and political cranks as a strong, outstanding personality of the type around which dictatorships have been built before.*

Opponents and colleagues who had indulged their ambitions to the extent of expressing opinions contrary to his were forced publicly to eat crow at the recent meeting of the Communist Party which occurred while we were in Moscow. It is very significant that the inspired press of the capital is now beginning to speak of him, no longer as "Comrade," but as "The Leader," a phrase strangely reminiscent of "Il Duce" of Rome.

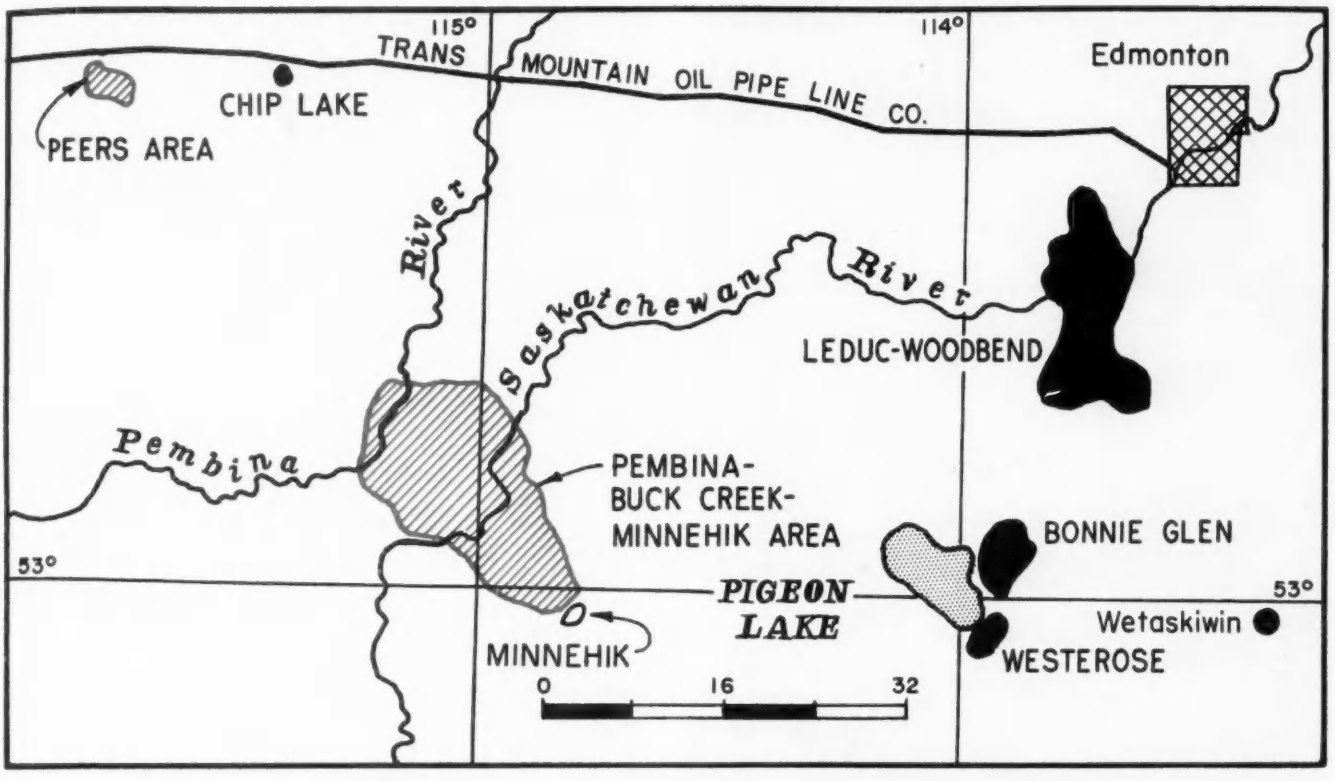
It is even prophesied that Stalin's first act upon openly assuming dictatorial power will be to withdraw from the Communist Internationale so as to free himself from the last vestiges of popular control. In such event, Stalin as absolute dictator may follow different policies and may rule along different lines than while maneuvering for control. No longer will he need to fan the flames of fanaticism and class hatred in order to gain his ends.

Stalin, be it remembered, is a Georgian, not a Russian.—**The End**

* Written in 1930.

REFERENCE

[1] From *The Soviet Union Looks Ahead,* The Five-Year Plan for Economic Construction, Horace Liveright, publisher, New York.



Pembina—North America's Largest Field?

Seventy miles southwest of Edmonton and verging on comparatively inaccessible Rocky Mountain foothills lies a new oil field which may include more than 250,000 acres.

OVER THE public address system in a south side Edmonton hotel came the call:

"Any roughnecks looking for work, report to the lobby."

In a Canadian city where the unemployed roll was higher than at any time since well before the war and in a country where the jobless situation was creating alarm from coast to coast, this call for roughnecks came as a refreshing development.

And it was a refreshing indication of the oil exploration and drilling work in Alberta which, in the past few months, has received tremendous impetus from early showings at Pembina, a brand new field which already is accepted as a major oil pool, probably superior in crude production to either Leduc or Redwater.

The new field discovery, say some persons affiliated with the field's development, now includes 250,000 proven acres, with two sides still to be defined. The vast East Texas field contains 134,000 proven acres.

Geographically, the Pembina area is in westcentral Alberta, about 70 miles southwest of Edmonton, 40 to 50 miles west and a little south of the Devonian reef fields of Leduc, Bonnie Glen and Wizard Lake, and verging on the comparatively inaccessible foothills country of the Rocky Mountains.

TYPICAL PEMBINA DRILLING TIME AND CONDITIONS

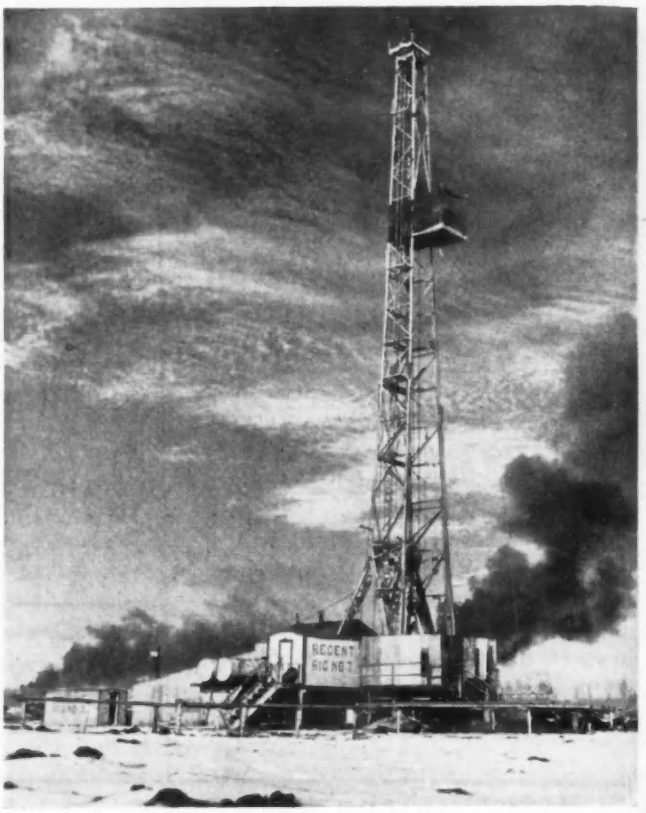
Well: Socony-Vacuum Oil Company's 30-10
Spudded in: Jan. 11, 1954
Temperature: 30-40 degrees below zero
Coring and testing: At 5280 feet on Feb. 8, 1954
Casing set: Feb. 9, 1954
Total days: 29
Contractor: Cascade Drilling Company Ltd.

The present phase of oil exploration history in the region goes back to March 27, 1950, when an exploration permit was taken out in an employe's name for Seaboard Oil Company of Delaware and Honolulu Oil Corporation.

Three years later, following an extensive seismographic program, the group, now reorganized, drilled the first well. Then, Socony-Vacuum Oil Company, as operator, held a 50 percent interest in the program; Seaboard and Honolulu retained 16⅔ each; Merrill Petroleums, Ltd., a Canadian company, held 10 percent and Canadian Collieries Oil & Gas Ltd., or Cancoll, 6⅔ percent.

History Made. Socony-Seaboard-Pembina 1 made Canadian oil history on June 20, 1953, when it found oil in the Cardium sands at about 5310 feet. The pay zone thickness was 30

LISTING BIDS. Premier Manning of Alberta (standing) looks over the listing of bids recently received by the government for oil and gas reservations and leases. Checking bids are Fred Morrison (left), supervisor of leases, and Dale Jordan.



TYPICAL SCENE. This is a drilling operation similar to those underway in Alberta's Pembina region. Since the first discovery, more than 15 successful wells have been drilled over a wide area. Indications are favorable in two extensions.

Alberta Government Photos

to 35 feet and an initial potential of more than 450 barrels a day was established for the discovery.

Geologist Cecil Jackman, statistician with the Alberta Department of Mines and Minerals, Edmonton, explains that the oil was found in a stratigraphic trap in sands of the Upper Cretaceous believed to be located in a Rocky Mountain trench running in a general north-south direction. The Cardium sands are the most recent geological oil bearing strata known in Canada although the formation approaching the mountains requires deeper drilling than it would if located out on the prairies.

Drillers at the discovery well were seeking Devonian production and drilled through the Cardium before plugging back for successful tests in the latter formation.

Since discovery, more than 15 successful wells have been drilled over a wide area, spreading the apparent pool over four townships. In addition, Stanolind Oil and Gas Company, in two extensions 10 miles west and a little north of the producing area and in one well about five miles west of the northerly Pembina strike, has reported favorable indications of oil in the same horizons. Cardium oil showings have been found in two of the wells, and drilling is being extended to test the Viking. Extension to the southeast of the key sector appears likely, with the latest producer about 12 miles from discovery.

A sample of possibilities from the heart of the area is shown in a drilling report from Socony-Seaboard-Violet Grove 30-2, situated 4½ miles southeast of the northerly Pembina well. The Violet Grove well, which found oil in the Cardium and Viking sands, also had showings in the Basal Blairmore and is now deepening to test the Madison formation.

Viking Oil. The well indicated Viking oil in a drillstem test from 5828-40 feet with gas flowing in 28 minutes at 25,000 cubic feet daily. Recovery was 225 feet of 37 gravity oil and 200 feet of salt water. Top of the Viking was found at 5830 feet (3005 feet subsea).

The Cardium was entered at 4860 feet. A 45-minute test from 4853-73 feet flowed gas in 12 minutes and gave 440 feet of oil and 220 feet of oil-cut mud.

At the present time, the principal producing area at Pembina comprises, from northwest to southeast, the Pembina, Buck Creek and Minnehik sectors. It is too early yet to speculate whether these sectors, extending over a distance of about 25 miles, ultimately will be joined to form a single pool.

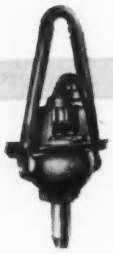
Probably the most interesting possible extension to the Pembina area came late in January when Shell Oil Company, drilling 30 miles due north of the most northerly Pembina well, found 34 gravity oil in the Cardium at 5000 feet. The Shell well is near Peers, on the Edmonton-Jasper rail line. Concrete indications that oil companies are taking the Peers find seriously is the fact that exploration has quickened still farther north, in the Whitecourt region about 75 miles northwest of Edmonton.

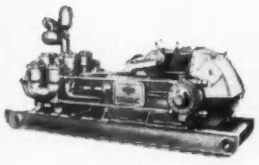
Although industry spokesmen are quick to warn that a tremendous amount of fill-in drilling still has to be made to substantiate the theory, the Cardium pool could extend 50 miles in a general north-south line.

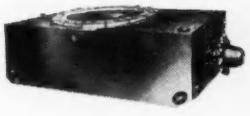
One report put the number of wells to be drilled by one company at "several hundred."

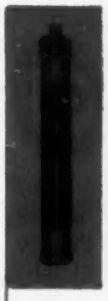
Estimates of reserves on the basis

Continued on Page 274









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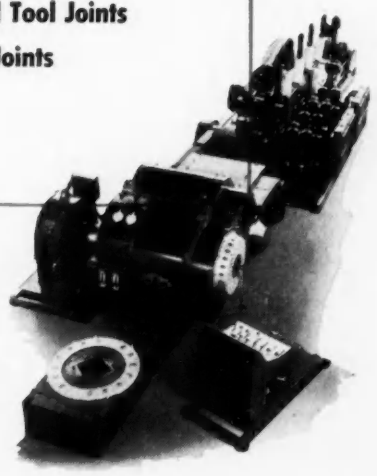

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New Law Signals New Era For Operations in Turkey

The aim now is 'prompt, uninterrupted and efficient development of petroleum resources . . .'

A NEW ERA of petroleum operations in Turkey was signalled in mid-March with the passage by the Grand National Assembly of a petroleum law, the stated objective of which "is the prompt, uninterrupted and efficient development and use of the petroleum resources of the Republic of Turkey through private initiative and investment."

The law also signified a change in the trend of developments in the Middle East since the Turkish law and Israeli oil law, that became effective in 1952, are the only ones in the area that encourage competitive development of petroleum resources. In all other Middle East countries oil development concessions have been granted to a single company and affiliated companies.

In Turkey the law represents a reversal of policy of the government, which for the past 20 years, in effect, had limited petroleum operations to a government agency through the restrictive provisions of the previous law that were not attractive to private capital. The results of the agency's efforts were the discovery of two small oil fields which produce about 300 barrels per day in face of a current daily demand approaching 20,000 barrels in the rapidly growing industrial nation.

Foreign Capital Welcomed. The law opens Turkey to complete petroleum development by foreign and domestic private capital in an atmosphere of complete free enterprise with a minimum of government regulation. Specifically provided for in the law is the right of petroleum companies to repatriate all profits accruing from petroleum operations. Also provided in the law is that holders of petroleum rights in Turkey may be required to first supply the domestic needs of the country from any petroleum produced in Turkey, but at market value prices established by world competitive conditions.

The law which was passed after intensive study was opposed in principle by the Republican Peoples Party (the present major opposition party in Turkey) since this party's platform encourages statism in economic fields. The party, however, supplied delegates to a parliamentary commission that studied the proposed draft law and many provisions of the law were from the suggestions of Republican party members.

The draft law was first prepared for the government by Max W. Ball, of Ball Associates, internationally known petroleum consultants, and Elmer E. Batzell, a U. S. petroleum legal expert, formerly with Petroleum Administration for Defense. Prior to passage, it was subject to considerable study by the Turkish Council of Ministers and the joint commission of the Grand National Assembly.

Primarily, the new law authorizes the granting of non-exclusive permits for exploratory work other than test drilling to any corporate entity or partnership, domestic or foreign, with the exception of foreign companies in which foreign governments hold a significant financial interest.

Five Years to Lease. A license is required for test drilling, and the holder of a license is given exclusive right for exploratory drilling and the exclusive right to get a production lease after making a discovery of oil on a maximum area of one-half the area held under license. The country is to be divided into 8 or 10 petroleum districts, basically conforming to geological structures in size, and licenses are limited to a maximum of 50,000 hectares (125,000 acres) and no more than eight licenses can be held by one entity in each petroleum district.

The term of a license is six years, but may be renewed up to a maximum of 10 years, subject to an annual rental of 18 cents per hectare in the first and second year and up to $1.05 after the tenth year. While a license has a maximum life of 10 years, it may be extended for an additional five years after a discovery is made to give the operator ample time to define the limits of a new field prior to making application for a productive lease.

This permissible five-year period allowed to apply for a production lease is a unique feature of the Turkish law. Under a production lease, the holder is entitled to exclusive drilling and producing rights on the leased area which has a maximum size of 25,000 hectares and no more than 150,000 hectares in each petroleum district.

Each company has complete freedom of selection in deciding on which portion of a licensed area to lease and there is no required "checkerboarding" of leased areas with the government as is required in several producing nations.

The holder of a lease is automatically entitled to conduct any other phases of the petroleum business in Turkey (refining, transportation) for which a certificate is required. A lease is valid for 40 years and may be renewed for a maximum of 20 years, the latter at terms to be set by the Council of Ministers.

Depletion Allowance. Owners of leases situated in whole or in part in one field may unitize their operations in such fields if the unitized operation is likely to prevent waste, to increase immediate or ultimate recovery or to lower production costs.

Production royalty is 12½ percent of the oil and gas produced, and in addition oil companies are subject to the normal Turkish corporation taxes on income, which under two laws, stipulate a maximum of 23½ percent in the case of foreign corporations. After an oil company has recovered its investment in its operation, it is subject to a surtax on income equal to 50 percent of net income, less normal income tax, direct taxes, rentals, and royalties paid. The 50-50 sharing of profits with the government, there-

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fore, is not required until after investments are recouped.

Under the tax provisions of the law, it is specifically stated that an oil company's tax liability is limited to income derived from operations in Turkey. The law permits similar tax deductions as are provided for under U. S. codes, including a depletion allowance of 27½ percent (or cost depletion, whichever is higher) and the operator, at his election, is permitted to expense or capitalize exploration costs, intangible drilling costs and the cost of dry holes.

Under the tax freedom permitted each operator, in effect, may select the term of depreciation. It means, however, that the faster the rate of depreciation selected, the sooner the oil company will get into the 50 percent surtax bracket.

Equipment needed for petroleum operations, other than consumer goods, may be imported free of duties and the equipment may be exported under similar conditions.

A separate law has been enacted which establishes the Turkish Petroleum Company, in which the government now owns 100 percent, but up to 49 percent of the capitalization is to be offered to individuals, to take over the operation of the Raman Dag and Garzan fields, discovered by the former government oil agency, Mineral Research and Investigation Institute. This company will also operate the 6250-barrel daily modern refinery now under construction at Batman. The government company will be in competition with private capital companies, but its prior rights of licenses and leases is limited by law to the areas at present being produced by the government and those in which the old M.T.A. had commenced drilling operations.

Administration of the new oil law will be by a Petroleum Administration, established under the Ministry of Industrial Development. The recently appointed president of the Petroleum Administration is the former M.T.A. director, Emin Iplikci, and his first assistant is Dr. Medet Egeras, a geologist also formerly associated with M.T.A. —**The End**

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Alberta Offers Well Production Data Service

The Alberta Petroleum and Natural Gas Conservation Board has announced that it now is prepared to offer companies and individuals the opportunity of subscribing to a well production information service providing a production record of every well in the province.

Data will be published on a 4 x 6 card giving name of well, location, name of field and, where necessary, the producing pool. Production data will include oil production, gas production, water production, water injected, oil allowable, and over or under production. Data will be given by months. Publication will be on a quarterly basis and will be about eight weeks following the last month in the quarter concerned.

Subscribers will receive records of all producing wells in the province. Subscription rate, for a 12-month period of four quarterly issues, is $600 for the first year of operations. This rate, however, may be reduced if there is sufficient response to the service.

There are slightly more than 4000 producing wells in the province.

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German Crude Reserves Show Major Increase

Proven crude reserves of the Federal Republic of Germany are estimated at 317,075,089 barrels as of Jan. 1, 1954. This figure was announced recently by Amt fuer Bodenforschung, Hanover, in cooperation with various oil company geologists.

Owing to successful exploration during the past year, the proven and probable crude reserve estimate has been increased by 28,268,000 barrels from Jan. 1, 1953, to 388,685,000 barrels, although 15,547,400 barrels of oil were produced in 1953.

The highest increase in reserves was noted for the area between the Weser and Ems rivers and for the Upper Rhine Valley. Discovery of seven new oil fields in the relatively new oil province between the rivers in 1953 made the proven reserve figure jump from 23,321,100 barrels to 39,186,515 barrels. By discovery and exploration of the Upper Rhine fields of Stockstadt and Rot, the Upper Rhine graben could, for the first time, be listed in reserve statistics with the 7,773,700 barrels, as compared with 1,130,720 barrels in 1953.

Since no new discoveries in Emsland or Holstein were made in 1953, production in those provinces resulted in a decrease of proven reserves. In Hanover, however, where the past year had seen the two discoveries of Kronsberg and Vorhop, reserves could be increased by 7,067,000 barrels to 80,054,976 barrels, though about 6,501,640 barrels of crude has been produced from Hanoverian reservoirs in 1954.

Preliminary Work in Yemen Is Progressing

First air photographs of Yemen are serving as basis for further mapping work by C. Deilmann Bergbau GmbH in the latter's effort to discover oil in southwestern Arabia.

The German firm is operating under a contract with the Yemen government covering permits to explore possible oil deposits. The Deilmann firm began preliminary geological explorations in the Salif zone six months ago. In the meantime, a gravimetric crew of Prakla has arrived in Yemen, and geophysical surveying has begun.

Pembina

Continued from Page 268

of successful wells are guarded, but there is little hesitation in naming the field a major one. Reserves at Redwater recently have been placed at 600 million barrels and at Leduc, 250 million barrels. Pembina is expected to exceed both.

Impact of the discoveries on Western Canada's drilling industry have been salutary. The year 1953 saw a levelling off in drilling activity and as the winter progressed, drilling companies were definitely retrenching.

Outlook for this summer is that all possible drilling will be done in the area but distances and poor roads probably will hold the program down somewhat. Another factor is that well spacing in the field is at present limited to 80 acres, although industry efforts are being made to have this changed to 40 acres, the spacing pattern that exists on the prairies.

Drilling problems, however, are at a minimum. So far, it has been described as very easy drilling, mainly through sandstone and shale. Very high bottom-hole pressures have been encountered, reaching 2700 pounds per square inch in some instances.

The number of wells to be drilled this year is difficult to ascertain. There are about 2500 proven or semi-proven locations in the area and wildcatting is likely to be at a maximum. Market factors, availability of rigs, speed of moving, etc., all enter the picture. From 200 to 250 wells is, in all likelihood, a reasonable estimate.

Market for the crude also is a question. Alberta's allowable in February was 262,195 barrels daily. This figure does not permit operation of some wells at their allowable for a full month. Some Devonian D3 wells at Leduc and Redwater fall into this category. No sharp upswing in markets is expected although the Trans Mountain line to the west coast will probably handle more than its 30,000 barrels a day as coast refineries increase operations.

Of importance is the fact that the Trans Mountain line passes only some 30 miles from the main Pembina sector field (only a few miles from the Peers outpost discovery) and probably eventually will be one of the main outlets for the field.

Price Effect. A major producing field such as Pembina may affect the price of crude, too. It is pointed out that a cut in the present price would probably mean the end of profitable production for some smaller wells, including some marginal D3 producers at Leduc and elsewhere. It also would work a hardship on smaller independents.

At present, there are five applications for pipe line permits from Pembina. These applications will go before the Alberta Petroleum and Natural Gas Conservation Board soon.

Other developments springing from the new field include:

- Plans by Alberta government to supervise building of a model oil community at Drayton Valley, the most central community. To be patterned along the lines of Devon, the oil town sponsored by Imperial Oil Limited after the Leduc discovery, the Drayton Valley center is expected to mushroom into a booming western oil town.
- An important aspect is the expectation of continued record revenue into Alberta. The first land sale after the Pembina drilling saw $28,502,192, a record amount, come in for reservations and drilling leases in the area.

Texaco Exploration paid $13 million for a 92,160-acre reservation starting about 15 miles northwest of discovery and Imperial Oil added another $11 million more for a similar acreage directly north of Texaco.

In addition, three quarter-sections in the heart of the field brought $1.5 million, and another large reserve to the south was taken by a Texaco subsidiary for $2 million.

As reservations are proved up, with half the acreage reverting to the government for resale on a checkerboard basis, a steady flow of bonus cash is expected.

Reservation areas bought by Texaco and Imperial are tracts set aside and barred from exploration in 1941 by the government. It was called at the time the initial step in a program aimed at orderly development of Alberta's oil resources. The region at that time, which had been subjected to surface geology and geophysical work by government engineers, was described as a promising oil area.

—**The End**

What's Happening

AMONG WORLD OIL MEN

W. A. GREEVEN, former representative in Lisbon of the Standard Oil Company (New Jersey) with respect to the company's interest in Portugal, Spain and the North and Western African countries, has joined Creole Petroleum Corporation in Caracas, Venezuela. Greeven brings to his new position an extensive background of oil experience gained in more than 25 years of service with many of Jersey's affiliates in Latin America and Europe.

W. A. Greeven

•

New directors of the Canadian Petroleum Association, Alberta Division, elected at the annual meeting of the Association recently at Calgary were A. G. BAILEY, Bailey-Selburn Oil and Gas Company; RALPH BINNING, General Petroleums of Canada Ltd.; R. C. BROWN, Hudson's Bay Oil & Gas Company; C. U. DANIELS, Royalite Oil Company Ltd.; BART GILLESPIE, British American Oil Company Ltd.; A. T. JACOBSEN, Amerada Petroleum Corporation; P. L. KARTZKE, Shell Oil Company of Canada; S. P. KING, Canada Southern Oils Ltd.; E. D. LOUGHNEY, Canadian Gulf Oil Company; W. D. C. MACKENZIE, Imperial Oil Limited; SMILEY RABORN, Canadian Delhi Oil Ltd.; N. E. TANNER, Cascade Drilling Company Ltd.; E. H. VALLAT, Triad Oil Company; W. A. WEIR, Oil Well Supply Company; A. F. WYNN, Amurex Oil Development Company.

•

ALFRED W. FARMILO, Western Leaseholds Ltd., Calgary, Alberta, has been promoted to the position of chief geologist of the company. Prior to the appointment he had been assistant chief geologist.

Tulsa Nomads Take Office

Newly-elected officers of the Tulsa Chapter Nomads who recently assumed their posts for 1954 are, seated, left to right: R. C. Glover, Baker Oil Tools, Inc., president; G. F. Coons, National Tube Division, U. S. Steel Corporation, regent and past-president; and Jack H. Beesley, Baroid Sales Division, National Lead Company, secretary. Standing, left to right: Dr. Oscar Irizarry, Petroleo Interamericano, assistant secretary; Don L. Collins, Republic Supply Company, vice president; John Pearce, Superior Iron and Supply Company, sergeant-at-arms; and E. L. Thomas, corresponding secretary. Other officers not shown include C. C. Crider, Bethlehem Supply Company, treasurer; Guy F. Williams, Dowell Incorporated, assistant secretary; Paul McGivern, McKissick Products Company, deputy sergeant-at-arms; and Gilbert M. Swift, Well Surveys, Inc., regent.

Venezuela Club of Houston Names Officers

R. H. Hume, left, Weatherford Oil Tool Co., Inc., was recently elected vice president of The Venezuela Club of Houston, succeeding Ray McDaniel, Gulf Oil Corporation. Other officers are, O. D. Tatsch, Houston Oil Company of Texas, treasurer; Miss Peggie Walters, Mid Century Oil Company, secretary; and F. A. Collier, Houston Oil Company of Texas, president.

Purpose of the Venezuela Club, which was organized in 1952, is to promote better understanding between U. S. and Venezuela and other Latin American countries. Membership is open to persons who have lived in Venezuela and to Venezuelans who now live in the Houston area. As a service organization, the club offers its assistance to those returning from Venezuela in an effort to help them find homes, learn about Houston schools, etc.

Meeting regularly on the last Friday of every other month, the club holds an annual barbecue on the Saturday nearest July 24, the birthday of Simon Bolivar, South American liberator. This year the barbecue will be held Saturday, July 24.

What's Happening

AMONG MEN IN THE INDUSTRY

H. F. Sinclair

W. G. Brady, Jr.

H. F. Sinclair, founder of the **Sinclair Oil Corporation** and a member of its board of directors since the company's formation in 1916, is retiring from the board with the expiration of his term of office May 19. In January, 1949, Sinclair retired as president of the company and was succeeded by **P. C. Spencer.** He continued as a member of the board and its honorary chairman. To succeed Sinclair the board has nominated **William Gage Brady, Jr.,** former chairman and president of The National City Bank of New York, and present chairman of the boards of American Enka Corporation, textiles, and of Fundamental Investors, Inc., an investment trust. During his banking career, Brady was a director or trustee of leading industrial, public utility and banking corporations, including Anaconda Copper Mining Company, American-Hawaiian Steamship Company, East River Savings Bank, Consolidated Edison Company of New York, The Western Union Telegraph Company and United Aircraft Corporation.

•

Harry Leyendecker, vice president of Eastern States Petroleum Company since 1948, has resigned to become an independent oil and gas operator in Houston. At the same time the board of directors of Eastern States announced the promotion of **James M. Curran** to manager of the Production and Exploration department.

•

Roy A. Kropp, chairman and president of Kropp Forge Company, Chicago, has been elected to the board of directors of **Transcontinental Oil Corporation,** Dallas, oil producing firm. Kropp also is president and a director of Kropp Steel Company, a director of Cenco Corporation, and chairman and a director of C. D. Gammon Company.

•

L. W. Goodrich was appointed production superintendent for **San Jacinto Petroleum Corporation** in Houston. Prior ot joining San Jacinto, Goodrich was associated with The Texas Company.

•

Earl M. Saxon, landman for Midstates Oil Company at Wichita, Kansas, has resigned to become an independent operator.

California Texas Oil Company Limited has announced the election of **A. J. Singleton** as executive vice president. Singleton's career in the oil industry began in 1924 with the Galena Signal Oil Company (of Ireland) Limited. In 1929 the Irish Galena Company was acquired by The Texas Company and in 1931 Singleton was appointed managing director of The Texas Company's English subsidiary in London. He became assistant general manager of The Texas Company's foreign sales division and when The Texas Company's European interests were acquired by California Texas Oil Company Limited, Singleton was made assistant vice president of Caltex. In 1948 he was elected vice president—marketing West of Suez and later was named vice president and director of the Caltex group, a position he held until his present election.

•

Sinclair Oil and Gas Company has announced the following promotions in its Production department at Tulsa: **Lloyd Holsapple** to chief petroleum engineer; **F. F. Wright** to assistant chief petroleum engineer; **C. L. Wilson,** engineering and technical assistant to the vice president and manager of production. All were formerly general staff engineers.

•

W. C. MacQuown, Jr., has resigned as head of Rocky Mountain operations for Deep Rock Oil Corporation to accept the position of chief geologist at Oklahoma City for **Sohio Petroleum Company.**

•

A. E. Collins, division engineer for Wilshire Oil Company of Texas at Midland, Texas, has resigned to become division engineer for **Vickers Petroleum Company,** at Wichita, Kansas.

•

Tide Water Associated Oil Company has announced the retirement of **Edward H. Salrin** after 40 years of service with Tide Water and its predecessor companies. Salrin has for the past 20 years served as vice president and director of Tide Water Associated and chairman of the operating committee of the Mid-Continent Division. He is a director of the American Petroleum Institute. In 1929 Salrin became president of the Tidal Oil Company and served in that post for 3½ years until Tidal was consolidated with Tide Water. He resided in Tulsa from 1914 until 1929 when he was shifted to the New York office of Tide Water and then transferred to Houston in 1932. Since then he has directed Tide Water's operations in the Mid-Continent area from joint offices in Tulsa and Houston.

Edward H. Salrin

E. W. Masters

B. P. Eastin

Shell Oil Company has announced the appointment of **E. W. Masters** as executive assistant to the vice president and **B. P. Eastin** as area production manager for the company's Pacific Coast exploration and production area. Masters, who has handled the duties of area production manager since 1944, has more than 27 years experience in the firm's Production department. He joined Shell in 1926 as a production engineer in Los Angeles and has since filled numerous positions in California and abroad. In 1938 Masters was named division manager at Bakersfield, a position he held until his move to Los Angeles in 1944. Eastin, who replaces Masters, has more than 15 years service with Shell. He began as a roustabout in Bakersfield and has since worked in all of Shell's major California oil fields, and in San Francisco. In 1951 he was appointed division production manager and served in that capacity at Long Beach and more recently in Ventura.

•

Leroy H. Hines, formerly vice president oil development, Northern Pacific Railway Company, and **J. B. Mitchell,** formerly assistant to the chief. Conservation Division, U. S. Geological Survey, Department of the Interior, announce the opening of offices in San Francisco and Washington, D. C. as petroleum consultants. The firm name is **Hines and Mitchell,** specializing in public and outer continental shelf leasing, operational and unitization problems.

•

Bradley, Oliver and Associates, petroleum consultants, announce the association of **Sidney H. Gottlieb.** A Texas A & M graduate, Gottlieb worked for Placid Oil Company as process control chemist in a cycling plant and conducted field tests for reservoir evaluation prior to service during the war. Gottlieb returned to Placid after the war, then entered business for himself. He has been an independent consultant and developer, primarily in evaluation of secondary reservoirs, before joining Bradley, Oliver and Associates in February, 1954.

•

Howard B. Keck, president, Superior Oil Company, Los Angeles, has been elected to the board of directors of **Gulf Interstate Gas Company,** Houston.

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FORMATION AND CASING TESTING — JOHNSTON

Bob Brinkerhoff has announced the opening of an engineering consulting office at 418 Pioneer American Building in Houston. Brinkerhoff will continue to specialize in appraisal reports and property management. A graduate of the University of Texas, where he received a B.S. degree in petroleum engineering, Brinkerhoff also did graduate work in geology and engineering. He has been associated with Petroleum Management Company and Livingston Drilling & Well Service, Inc., during the past 2½ years as consulting engineer and production superintendent. Before joining Petroleum Management Company, he was a field engineer for American Republics Corporation.

Bob Brinkerhoff

•

Joe B. Avant has resigned as geologist for Stanolind Oil & Gas Company to join the geological staff of British American Oil Company at Tyler, Texas.

•

R. H. Martin, district geologist at Midland, Texas for **The Texas Company,** has been transferred to Houston as executive staff geologist.

•

Warren-Bradshaw Exploration Company, Tulsa, has announced the promotion of **Don O. Freeman** to the position of assistant to the president of the firm. Freeman will coordinate functions of the executive department with the company's various operational departments.

•

T. N. Law, Jr., has returned to his duties as industrial relations manager of **Falcon Seaboard Drilling Company** after an absence due to illness. He is working full time again in Falcon Seaboard's main office in Tulsa.

•

W. H. Gibson has been appointed assistant to division manager, Geophysical Division of **The Texas Company's** Producing Department. A graduate of Rice Institute, Gibson joined The Texas Company in 1935. He worked in the South Texas Division, in the Oklahoma Division, and in Canada before he was promoted to supervisor of field operations, Houston, in 1949.

W. H. Gibson

•

Mesa Drilling Company has announced the appointment of **R. G. (Rusty) Cunningham** as general superintendent in charge of drilling operations of the company. Cunningham brings to the company years of drilling experience throughout the continent and formerly was with C. G. Glasscock Drilling Company of Corpus Christi, Texas. Cunningham presently is making his headquarters in Newcastle, Wyo.

The Coyote-Killer Winner!

At the Helmerick and Payne Rig No. 34 located 25 miles west of Jal, N. M., a contest took place recently which drew much interest and gave the winner, Toolpusher John Crow a new name.

One night Crow killed a coyote and was thereby challenged by the crew to a contest. That night the crew, too, killed one, putting it on the west side of the cattleguard. Crow's coyote was hung on the east side and the contest began. Twenty-nine coyotes and two eagles later, "Dead Eye" Crow was declared winner. During the contest, visitors found that directions were no longer given in terms of regular miles. Instead they were told to "look for three-quarters of a mile of coyotes hanging on the fence at the turn-off."

•

Charles E. Pittman has joined **Norbla Oil Company** as chief geologist in Tulsa. He resigned as district geologist with Champlin Refining Company in Enid.

•

Okmar Oil Company of Marietta, Ohio, has established its Mid-Continent area headquarters in Wichita, Kansas, with **Sheldon K. Beren** as division manager and **Robert M. Beren** as district manager.

•

Dorman J. Morsman has been named treasurer and director of **Keating Drilling Company.** Morsman previously had been secretary of the company, a position he retains.

•

Walter D. Abel has announced his retirement as mining and petroleum engineer for the **Division of Corporations, State of California,** to engage in private practice as a consultant.

•

V. E. Middlebrook, engineering consultant of Tulsa, Oklahoma, has gone to Bogota, Colombia, to make an economic study of the five natural gasoline plants engine operated in Colombia by Empresa Colombiana de Petroleos.

John O. Ely, senior research technologist with **Magnolia Petroleum Company's** Field Research Laboratories, Dallas, was named winner of Socony-Vacuum Oil Company's 1954 Incentive Fellowship. Magnolia is the southwestern affiliate of Socony-Vacuum. Ely, the twelfth winner, will work toward the degree of Doctor of Science in electrical engineering at Massachusetts Institute of Technology.

John O. Ely

•

J. Edward Brantly, C. Stribling Snodgrass and Associates, geologists and engineers specializing in oil and gas developments, announce the establishment of offices in Suite 707, Washington Building, Washington, D. C.

•

Cities Service Oil Company's new field representative for its Crude Oil Supply division in Louisiana will be **F. W. Stewart** of Bartlesville. Stewart will have headquarters in New Orleans. He joined Cities Service in 1936 and has worked in the secretary's and treasurer's division at Bartlesville since then. Stewart become assistant cashier for the company in 1951, a position held until his recent transfer to the Crude Oil Supply Division. Stewart succeeds **R. M. Foster,** who was transferred from the New Orleans post to the Bartlesville headquarters office.

•

Gulf Oil Corporation has transferred **R. P. Huggins,** vice president, to its Pittsburgh general offices. He will direct the crude oil purchases and products supply operations. The newly-formed department, which combines the activities of products supply and distribution, formerly under the direction of the Domestic Marketing department, and crude oil purchasing, will be known as the Crude Oil and Products Supply department. Huggins, a veteran of 33 years with Gulf companies, has been at Houston as vice president in charge of crude oil purchases since 1952. Previously he was a vice president of the Western Gulf Oil Company, a production subsidiary on the West Coast. Assisting Huggins as manager of products supply and distribution will be **R. O. Jennings.** Previously he was director of supply for the Domestic Marketing department.

R. P. Huggins

•

Harold F. Clary has been elected a member of the board of directors of **Signal Oil and Gas Company.** Clary, who has been with the company 20 years, has been a member of the legal staff and for the past several years has served as assistant secretary. He was graduated from the University of California Law School at Berkeley.

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Charles D. Vertrees, Midland, Texas, division geologist for **Continental Oil Company**, has been promoted to the newly-created position of regional research geologist for the company's southwestern region. He will continue to make his headquarters at Midland. Vertrees joined Conoco in 1925 as land man. He served as district geologist at San Antonio and Midland before becoming division geologist at Midland in 1950. Before joining Conoco, Vertrees spent two years as a geologist in Mexico.

•

Edward E. Emrick, Jr., director of purchases, has been appointed exploration-production manager of **Ashland Oil & Refining Company.** The Exploration-Production department has principal offices in Ashland and Henderson, Ky.; Midland, Texas; Shreveport; Oklahoma City and Billings, Mont. Emrick, who joined Ashland Oil in 1931, was named assistant treasurer in 1932, assistant secretary in 1937, and during the past 12 years has headed the Purchasing department. During the same period he has handled other administrative and executive assignments including the management of several of the company's production districts. **Frank L. Fisher** continues as chief geologist of Ashland with increased responsibility for exploration activities. Fisher joined Ashland Oil as a geologist in Evansville, Ind., in 1943. Prior to his appointment as chief geologist in 1953, he had been senior geologist in Evansville, senior geologist and regional geologist in Ashland, Ky. Another promotion in the company's Exploration—Production department brings **Nace F. Mefford, Jr.** to Ashland as chief production engineer. A graduate of the Missouri School of Mines, Mefford was first employed by Ashland Oil in 1948 as a petroleum engineer at Henderson, Ky. He was production engineer at the Henderson office of the company before his transfer to Ashland.

•

M. E. (Mel) Thrash, former divisional land superintendent of the New Mexico division for Continental Oil Company, has formed his own company, the **Mel Oil Company**, and established offices in the Burlingame Building in Bartlesville, Okla. Holdings are in Washington, Osage, Nowata, Noble and Kay counties. The firm is primarily concerned with production. Thrash was with Continental 10 years.

•

Frederick G. Coqueron has been appointed to the official staff of the Chase National Bank of New York as petroleum analyst. Coqueron joined Tide Water Associated Oil Company in New York in 1923, remaining for 13 years as financial statistician. He joined the Petroleum department of Chase in 1936, developing statistical data relating to the oil industry. He authored such studies as "Financial Analysis of 30 Oil Companies," an annual survey covering the financial and operating aspects of the petroleum industry on a world-wide basis.

•

John A. Ritter, superintendent of the Operating department for **Sun Oil Company's** Southwest Division, has retired after 31 years of service. **A. S. Rhea** succeeds Ritter. Rhea has been chief petroleum engineer and assistant superintendent, Operating department. **F. G. (Gus) Prutzman**, assistant chief petroleum engineer, assumes Rhea's former duties and title of division petroleum engineer.

DEATHS

R. T. McCoy, 63, recently retired and former manager, African Marketing department of **California Texas Oil Company, Limited**, died March 26 in New Jersey. A pioneer in the development of foreign markets, McCoy had completed more than 35 years in the oil industry with Caltex or affiliate companies.

•

Charles A. Yeatman, 51, southern California oil man, died March 24 in New York where he was on a business trip. In recent years Yeatman had been at Shell Oil Company's Los Angeles offices as chief mechanical engineer.

•

Charles Hayward Murphy, Sr., 84-year-old oilman, banker, planter and timber tycoon, died at his El Dorado, Ark. home April 3. He was a partner in C. H. Murphy & Co. with oil holdings in Arkansas and Louisiana.

•

H. P. Carroll of Houston, vice president and operating manager of the Texas distribution division of United Gas Corporation, died in Rochester, Minn., April 6. His death ended a career in the gas industry which began in 1911 when he went to work as a map maker for the old Beaumont Gas Light Company. Since 1930 Carroll had been an executive with United Gas Corporation and predecessor companies in Houston.

•

Lewis H. (Hick) Kern, of Houston, president of Kern Directional Drilling Corporation, died February 20. Formerly of Oklahoma, Kern founded the company in Houston in 1949.

•

Ernest K. Moss, 78, retired Tulsa oilman, died March 17 in Tulsa. Moss settled at Haskell in 1902 and operated a bank there for several years before moving to Tulsa in 1908 where he was an independent operator until his retirement several years ago.

•

Lester T. Burns, Sr., independent oil producer, was killed March 17 in an automobile accident near Henrietta, Texas.

•

Howard L. Cunningham, 62, of Tulsa, retired Shell Oil Company official, died at his home. He was assistant to the vice president of Shell for about five years before retiring in 1951.

•

Dr. Frank Wenner, 81, internationally known physicist and geophysicist, died recently. Dr. Wenner had been active in consulting work at the National Bureau of Standards until his death.

•

Karl Brown Conway, 68, former Tulsan, assistant to the vice president in charge of production for the Gulf Oil Corporation until his retirement in 1951, died March 24 in Pittsburgh.

•

Walter E. Brown, 66, counsel of Sinclair Refining Company since 1942, died March 24 in Darien, Conn.

•

Harry H. Smith, 84, retired oil drilling contractor and Tulsa resident since 1901, died March 25 near Tulsa.

What's Happening

AMONG INDUSTRY ASSOCIATIONS

Gas Association Plans Legal Conference in June

The American Gas Association, in cooperation with the Practising Law Institute is planning a symposium on "Current Legal Problems of the Gas Industry," to be held in New York City June 7-11.

Discussion of practical value to gas utility and pipe line company lawyers and executive will comprise typical gas industry legal problems from Wellhead to burner tip. Subjects will include natural gas field supply, negotiations and analyses of gas purchase contracts, state commission prorations and minimum price orders, effects of the Phillips decision, transportation and common carrier problems, rate-making matters, economic depreciation, determination and distribution of refunds and many others.

South Texas Oil Show To Be Held May 13-15

The second South Texas Blowout celebration has been set for May 13-15 in Alice, Texas. This year's Blowout will be dedicated to the oil field workers of South Texas. The program includes an opening day parade, a Texas barbecue, ceremonies honoring oil field workers, the story of oil in fireworks, dancing to a big name band, a golf meet, homecoming events, and exhibits showing the latest oil industry machinery, equipment and products.

Desk and Derrick Club Formed in Richmond

Ann McCabe, Atlantic Refining Company, was named chairman of the charter and bylaws committee and Anne Foos, American Oil Company, was named to head the nominating committee at a recent organizational meeting of the Desk and Derrick Club of Richmond, Va.

Elinore McAdam, regional director for the Association of Desk and Derrick Clubs of North America, spoke at the meeting. Acting officers for the group are Martha R. Ross, Virginia Petroleum Industries Committee, chairman; Mary Stuart Wade, Esso Standard Oil, vice chairman; Marjorie Gordner, Sinclair Refining Company, secretary; and Frances Anderson, The Pure Oil Company, publicity chairman.

AAODC Safety Clinic Slated For May 13-14 in Dallas

Human and mechanical aspects of safety will be discussed at the Ninth Annual Drilling Safety Clinic of the American Association of Oilwell Drilling Contractors, May 13-14, at the Baker Hotel, Dallas.

The first day's program, to be opened with an address by K. L. Kellogg of K. L. Kellogg & Sons, Compton, Calif., president of the AAODC, will be devoted largely to safe practices in handling equipment, with talks also scheduled on fire prevention. Managerial aspects of good safety programs will be stressed during the concluding sessions.

Woodward Named TIPRO Head During Houston Convention

Jack S. Woodward of Dallas was elected president of the Texas Independent Producers and Royalty Owners Association at the final business session of the eighth annual meeting in Houston in April.

Woodward, a petroleum engineer graduate of the University of Texas, was employed by Magnolia Petroleum Company as district petroleum engineer in 1937. He later resigned to head the petroleum corporation bearing his name, engaging for a time in independent consulting work.

Woodward's oil industry affiliations include TIPRO, Texas Mid-Continent Oil and Gas Association, Mid-Continent Oil and Gas Association, IPAA, AIME, AAPG, Dallas Petroleum Engineers Club, and Dallas Geological Society.

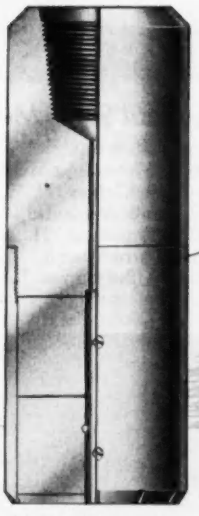
The Newest Fishing Lure

The

BOWEN KINGSTON FISHING MAGNET

Bowen Kingston Fishing Magnets are used to retrieve all types of small objects having magnetic attraction such as bit cones, slips, milling cuttings, tong pins, hammers, etc. These odd shaped, undrillable objects gather at the bottom of the hole as a result of tool failures and milling jobs or are accidentally dropped down the hole. Such objects cannot be engaged in any conventional manner and in many instances can be engaged and retrieved only with magnetic attraction.

Bowen Kingston Fishing Magnets are an indispensable accessory for all diamond coring operations. Small junk particles such as teeth chipped from bits, broken bearings, etc. can seriously damage a diamond core bit or curtail its performance. In a single run Bowen Kingston Fishing Magnets can completely cleanse the hole of all such particles, safeguard the bit from damage, and insure good performance.



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Patented

Keeper for Bowen Kingston Magnet

SIMPLE AND COMPACT

The Bowen Kingston Fishing Magnet is a simple, compact tool consisting of a Body, a non-magnetic stainless steel Sleeve, and permanent Magnets. There are no moving parts. The Plate protects the Magnets from any damage that might result from physical contacts. All sizes of these tools are provided with a circulating hole large enough for all standard purposes.

The magnet elements are made of the most advanced magnetic alloy which is magnetized as an assembly and specially treated to insure axial lines of force at the pole faces. The power of the Bowen Kingston Fishing Magnet is concentrated at its engaging end. This avoids any attraction with the walls of the casing and assures unrestrained lowering into the well.

CAN BE RUN ON WIRE LINE OR PIPE

Wire line operations have the advantages of speed and economy. Pipe operations have the great advantage of circulation, which can be used to eliminate settlings above the fish and to loosen the fish.

LONG LIFE

With proper care, the life of the Magnets can be prolonged indefinitely. Keepers are furnished with each Bowen Kingston Fishing Magnet to prevent magnetic dissipation while the tool is not in use. The magnetic attraction holds the Keeper in place and Cap Screws are provided to jack the Keeper off the Magnet.

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What's Happening

AMONG SERVICE AND SUPPLY MEN

WECO Completes Annual Sales Meeting

WECO representatives from all territories gathered recently at the company's home office and plant in Houston for the annual sales meeting. Attending were, left to right, front row: W. H. Brien, J. C. McCelvey, C. E. Gisler, I. D. Abshire, and C. V. Marshall. Second row: D. E. Owens, Frank Wiegand, Chiksan Company; W. H. Stewart, W. H. Stewart & Company; J. H. Robinson, A. H. Watts, R. E. Gammill, R. T. Jones, Chiksan Company; and O. J. Viator. Third row: L. L. Durkin, R. B. Feistel, Jr., W. H. Stewart & Company; and T. R. Shields. Back row: John W. Gates, C. J. Holcomb, F. A. Jordan, and W. C. Meeks, Jr.

Venezuelan Itinerary Planned

G. I. Lynch, center, export manager of Lee C. Moore Corporation; R. D. (Jack) Woods, right, plant superintendent, are shown outlining an itinerary for Donald E. Hansen, left, Latin American sales and service engineer, just before Hansen and Woods left the United States for Venezuela.

Bauer Sells Interest In Cherokee Laboratories

George F. Bauer, Jr., president of The Cherokee Company, Tulsa, has announced his resignation as chairman of the board, vice president and director of Cherokee Laboratories, Incorporated and Caribe Oil Well Products, Inc., Tulsa. Bauer sold his interest in these companies to David A. Garrick, president of Cherokee Laboratories, Inc., and R. D. Denny, secretary-treasurer. Garrick and Denny moved to Tulsa from Chicago about a year ago.

Bauer organized and founded these companies two years ago after having received an exclusive franchise from the Stanolind Oil & Gas Company Research Laboratories in Tulsa to manufacture and distribute ground walnut shells.

These ground walnut shells are used to combat lost circulation in oil well drilling mud and also as an additive in cement. This product has been sold under the trade name "Tuf-Plug." Bauer reports that in the first two years of operation under his direction that the corporation did about a half-million dollars worth of business.

Kaiser Steel Announces Sales Appointments

J. H. Webber has been appointed assistant manager of tubular products sales, general offices, Oakland, Calif.; and T. H. Wakeman named Mid-Continent district sales manager, Tulsa. Webber who comes to the Bay area from Tulsa where he was Mid-Continent sales manager, joined the steel sales staff in 1946 in the company's general offices.

Wakeman joined the Kaiser Steel sales staff in 1950. In 1951 he served as assistant to the manager of tubular sales and was Mid-Continent district sales representative in Houston prior to his new appointment.

Water Transportation Firms Make Merger Agreement

S. C. Trimble has been elected president and a director of Gulf-Canal Lines, Inc. and Edgar W. Brown, Jr. and B. L. Morris, both of Orange, Texas, were named to the board of directors of the firm.

This action came as a result of an operating agreement entered into between Gulf-Canal Lines, Inc. of Houston and Higman Towing Company of Orange, Texas, looking towards a merger of the two companies.

Other officers named were Chester D. Bintliff, executive vice president; Morris, secretary and assistant treasurer, and J. H. David, treasurer and assistant secretary.

The move was made to allow these two companies to provide complete transportation service by water along the Gulf Coast. Offices are maintained in New York, St. Louis, Mobile, New Orleans, Orange and Houston.

Dresser Industries Plans Expansion in Tulsa Area

The signing of a purchase agreement with Industrial Sites, Inc., of Tulsa, covering approximately 15 acres located at the northwest corner of Sheridan Road and 15th Street in the New Sheridan industrial district of Tulsa, has cleared the way for further expansion by Dresser Industries, Inc., of Dallas, in the Tulsa area.

Consummation of the agreement and the start of a long-range program involving an ultimate capital expenditure of more than a million dollars has been jointly announced by J. B. O'Connor, executive vice president of Dresser Industries, Inc., and Ray H. and Robert M. Siegfried, owners of Industrial Sites, Inc., of Tulsa, developers of the New Sheridan Industrial District in that city.

While final plans will be developed to fit the Dresser companies' eventual needs, the immediate program calls for the construction of a modern brick office building and a warehouse building fronting on Sheridan Road, now being designed by Black and West, Tulsa architects. Construction of this initial building is to start as soon as these plans are approved.

Clark Bros., of Olean, N. Y., one of the largest Dresser operating companies, and leading manufacturers of electric, steam and gas engine-driven compressors, will move from its present Tulsa location into these new quaraters early this summer. Regional sales and service engineering offices and warehousing, together with a complete parts depot will be set up by Clark immediately upon completion of these new facilities.

As soon as present lease commitments expire, the other Dresser subsidiaries will be relocated at the new Tulsa site. One of these, Pacific Pumps, Inc., of Huntington Park, Calif., will likewise establish centralized regional Mid-Continent sales and service offices and reconditioning facilities for its line of oil well plunger pumps, as well as Mid-Continent regional sales offices for Pacific's centrifugal pump line.

Future plans call for other Dresser operating companies to be moved to the new Tulsa location, which will eventually house a representative group of the nationally known oil equipment firm's member companies. In addition to Clark Bros. Co. Div. and Pacific Pumps, Inc., other Dresser firms are Bovaird & Seyfang Mfg. Co., Bradford, Penn.; Dresser Manufacturing Division, Bradford; Ideco Division, Columbus, Ohio, Dallas and Beaumont; Kobe, Inc. Div., Huntington Park; Magnet Cove Barium Corp., Houston; Roots-Connersville Blower Division, Connersville, Ind.; Security Engineering Division, Whittier, Calif., and Dallas; and Stacey Brothers Div., Cincinnati, Ohio.

Lane-Wells Transfers O'Haver to Oklahoma City

M. P. O'Haver, formerly Rocky Mountain district superintendent of Lane-Wells Company, has been appointed assistant division operating superintendent of the Mid-Continent Division and transferred from Casper, Wyo., to Oklahoma City.

J. F. Alexander, formerly assistant to the division operating superintendent of the Mid-Continent Division, has been promoted to Rocky Mountain district superintendent in Casper.

Donald R. Kirchner, formerly gun perforator operator at Perry, Okla., has been appointed district sales engineer trainee at Russell, Kan.

Farish Named Board Chairman Of Reed Roller Bit Company

S. P. Farish

R. G. Hamaker

H. C. Tooley

W. B. Noble

E. F. Snow

Stephen P. Farish, president of Reed Roller Bit Company since 1925, was named chairman of the board April 14 at the annual meeting of the board of directors. At the same time R. G. Hamaker, formerly vice president—sales, was elevated to succeed Farish as president and H. C. Tooley, formerly vice president—manufacturing, was elected executive vice president. The positions of board chairman and executive vice president are newly-created positions with the company.

W. B. Noble was named first vice president—engineering and E. F. Snow, second vice president and treasurer. Both had previously been vice president.

Farish has been with Reed for 30 years, his service dating from 1924 when he was a partner in a small oil tool company later absorbed by Reed. Hamaker has been with the company nearly 26 years, Tooley 17 years, and both Noble and Snow more than 18 years.

Farish has spent all his professional life in the oil business. He started in 1908 when he interrupted his schooling at the military academy at Sewanee, Tenn., to work for the E. F. Simms Company in Texas as a roughneck for nine months before returning to school.

In 1915 he moved to Humble as driller for R. L. Blaffer and Will Farish, his brother, later becoming production manager. It was at Humble that Steve Farish first encountered what was later to be known as the Reed Roller Bit, but what was then the Humason Bit. G. A. Humason, the inventor, credits S. P. Farish as one of the first drillers to use the bit.

When Humble Oil and Refining Company was formed in 1916, Farish was one-third owner of Globe Refining Company, one of the companies of which Humble was formed. He was manager of Humble's northern division when he resigned in 1922 to form a drilling contracting company in partnership with Joe Collins and Ed Watts. The company later became the Navarro Oil Company, which was sold to Continental Oil Company in 1945.

In 1925 Farish joined with the syndicate that purchased the Reed Roller Bit Company from C. E. Reed and became president of the reorganized tool company.

Herschel V. Hiatt Named Le Roi Engineering Director

Herschel V. Hiatt, formerly assistant chief engineer for the Allison Division of General Motors, has been named director of engineering for the Milwaukee Division of Le Roi Company.

Hiatt will be responsible for the organization of the engineering department at Le Roi and the direction of its efforts. He will also be chairman of the product development committees, and will be responsible for the engineering department's recruitment and educational policies.

Hiatt has worked with the Allison Division of General Motors since 1938, and before that was with Warner Corporation. An expert in engine design, tooling and product production, he is a graduate of Purdue University.

Caterpillar Reassigns Territories, Appoints South African Dealer

Caterpillar Tractor Company has announced two territorial reassignments and the appointing of a new dealer in South Africa.

The territory of Thos. Barlow and Sons Ltd. of Johannesburg, Transvaal, South Africa, now includes the Province of Transvaal, the Magisterial Districts of Warden and Harrismith in the Orange Free State, the native territory of Swaziland, the Divisional Councils of Mafeking, Vryberg, Kuruman, Taungs, Barkly West, Kimberley, Hay and Herbert in the northern portion of the Cape Province and Bechuanaland Protectorate.

The territory of Thos. Barlow and Sons Ltd. of Durban, Natl, South Africa, has been altered to include the Province of Natal, all of that portion of the Cape Province from the Natal and Basutoland borders to and including the Bunga Areas of Mount Fletcher, Mount Frere, Tabankulu, Lusikisiki and Port St. John's of the Transkeiian General Council.

The territory being assigned Barlow's Ltd. of Bloemfontein, O.F.S., South Africa, the newly appointed Caterpillar dealer, takes in the Province of Orange Free State except the Magisterial Districts of Warden and Harrismith and the native territory of Basutoland. This territory was formerly a part of the territories of Thos. Barlow & Sons (S.A.) Ltd. and Thos Barlow and Sons (Natal) Ltd.

Wilson Supply Distributes Carter Units in Two States

S. C. Carter Company, Inc., Los Angeles manufacturers of the Carter long-stroke hydraulic pumping unit, announce the appointment of Wilson Supply Company as distributors for Arkansas and Louisiana.

Wilson Supply Company, which already distributes Carter units in South Texas, will handle sales and service in their new territory from their offices at Harvey, Houma, Lake Charles, New Iberia and Shreveport, La. Don C. Lawrence of Wilson Supply Company has been designated to handle the Carter line with headquarters at Shreveport.

Emsco Appoints C. L. Fox To Drilling Mast Sales

Charles Leroy Fox has been appointed drilling mast-sales engineer of Emsco Manufacturing Company. Fox has many years experience in the design and construction of drilling masts and other oil field structures. Prior to joining Emsco, he was president of the Fox Diamond Derrick Company. He will have headquarters in Emsco's Dallas offices in the Continental Building.

Charles Leroy Fox

Lane-Wells Opens New Branch To Serve Eastern Kansas

Mounting activity in the eastern Kansas fields has prompted the opening of a new Lane-Wells branch at Chanute, Kan. The new branch, located at 12 South Evergreen, is equipped to provide perforating service and radio-activity well logging service on the usual 24-hour a day basis.

Bell & Gossett Announces Executive Appointments

E. J. Gossett, president of Bell & Gossett Company, has been elected chairman of the board. R. E. Moore, vice president and secretary, and Clarence E. Pullum, vice president and treasurer, were named executive vice presidents.

D. E. Whittenberg

Harold L. Brown

B. F. Krause

Vernon B. Scott

Garrett Oil Tools Names New Vice Presidents

D. E. Whittenberg of Houston and Harold L. Brown of Dallas have been elected vice presidents of Garrett Oil Tools, Inc., of Longview, Texas, and have also been appointed as managers of sales in two recently created company sales regions.

Whittenberg, formerly manager of the company's Southwest Texas division, is in charge of the southern region, including the oil producing areas commonly referred to as South Louisiana, the Texas Gulf Coast and Southwest Texas.

Brown is manager of the northern region which includes East Texas, North Texas, West Texas, North Louisiana, Arkansas and Oklahoma. He was formerly manager of the East Texas and West Texas divisions.

B. F. Krause, former manager of the Texas Gulf Coast Division, was made manager of the company's Export Division, and also placed in charge of the areas where Garrett products are distributed through independent sales agencies. Krause will also serve as technical coordinator between the sales and engineering departments.

Vernon B. Scott, formerly manager of the distributing agency for Garrett Relief Valves, was named manager of the Relief Valve Division of the company.

Le Roi Names Keenan Director of Personnel

Le Roi Company has named John W. Keenan director of personnel, Milwaukee division.

Keenan will be responsible for the organization and direction of the over-all industrial relations program at the Milwaukee division, including labor negotiations, wage and salary administration, management development and employe benefit plans. Formerly staff assistant, Labor Relations Department for General Mills, Inc. Kennan started with General Mills in 1938 as a machine operator.

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Southern Engine & Pump Advances Reynolds to Manager

R. H. (Dick) Reynolds has recently been appointed manager of the Southern Engine & Pump Company in Lafayette, La. Reynolds is a mechanical engineer and is a graduate of the University of Houston. He joined Southern Engine & Pump Company in 1952 and served with the Houston office in the Engineering Department prior to his transfer to Lafayette. This office will specialize in engineering and furnishing Peerless and other nationally-known pumps, LeRoi Gas/Gasoline Engines, Nordberg Diesel Engines, and custom built generating sets and pumping units.

R. H. Reynolds

Morse Chain Expands Sales Organization

Expansion of the nationwide sales organization of Morse Chain Company has been announced. A new midwest sales territory embracing Wyoming, Utah, Colorado, Nebraska, Kansas, Missouri, and parts of Illinois, Kentucky, Tennessee, Mississippi, and Arkansas has been established to assist present Morse representatives, and 23 distributors in the area.

C. B. Lane, newly appointed factory representative, will head the new midwestern sales office, in Overland Park, Kan. He was formerly a power transmission equipment salesman for Noelling Steel Sales Corporation.

The appointment of R. J. Donachie as manager of the Morse Chain Philadelphia office was also announced. He was formerly an industrial salesman for Philadelphia Gear Works.

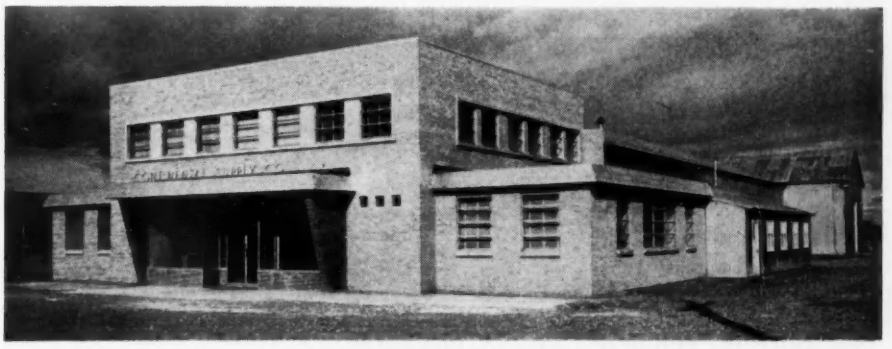
John M. Stevenson Joins Continental Supply Company

John M. Stevenson has joined The Continental Supply Company as Tubular Engineer. He will be concerned primarily with technical problems on line pipe and oil country tubular goods.

For the past year Stevenson has been chief engineer, Oil Field Products, with the United Machine Company. The three previous years were spent with The Youngstown Sheet and Tube Company as development engineer on pipe line problems. His experience also includes tubular goods research with Phillips Petroleum Company.

Stevenson, who will work out of the Dallas home office of the oil field supply company, graduated in 1937 as a mechanical engineer from Texas A. & M. College.

John M. Stevenson



New Store Opened in Wyoming

The Continental Supply Company has formally opened its new Casper, Wyo., district office, store and warehouse. Under the direction of District Manager W. D. Craig, Casper serves as headquarters for the company's entire Rocky Mountain operation. The front portion of the new building houses the store on the first floor and district offices on the second. The warehouse is in the rear of the building.

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More Footage at Lower Cost—

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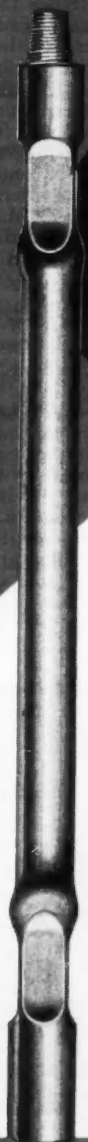

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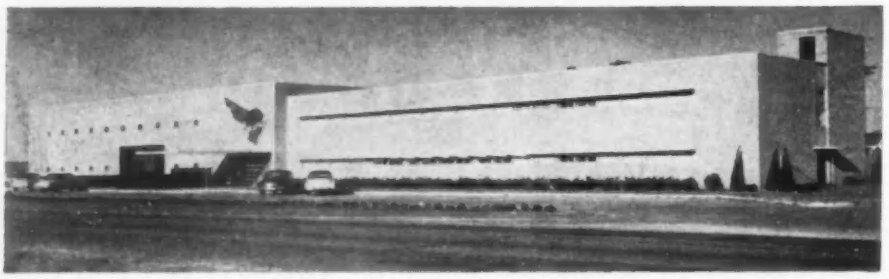

Halliburton Technical Center Completed

One of the newest research facilities in the petroleum industry is Halliburton Oil Well Cementing Company's Technical Center at Duncan. The Technical Center brings together in one building all of Halliburton's home office technical groups—engineering, mechanical research, electrical and chemical. The $600,000 building has 32,000 square feet of working space and houses 165 technical personnel. New research shop and deeper experimental well, not shown, will be completed this spring adjoining the Technical Center. Halliburton's primary research center for electrical well services is located in another modern plant in Houston.

Lane-Wells Makes Changes In Gulf Coast Personnel

Supervisory and sales changes have been announced by Lane-Wells Company in the Gulf Coast Division.

N. E. Wilson, sub-district superintendent at Alice, Texas, has been transferred to McAllen in the same capacity. G. T. Gower, formerly sub-district superintendent at McAllen, has been assigned to Alice in the same capacity.

Ralph Grant, formerly personnel manager in Los Angeles, has been appointed district sales engineer at New Orleans.

W. H. Redford, Jr., and R. E. Pearson, formerly district sales engineers at Magnolia, Ark., and Longview, Texas, have been reassigned in the same capacity to Shreveport, and Magnolia respectively.

H. M. Renfroe, who has been on military leave of absence since January, 1952, has returned to the company at Alice, as district sales engineer.

Westinghouse Appoints Rowland, Bartlett to Top Division Posts

Westinghouse Electric Corporation has announced key appointments in the top management of the company's Steam Division and Manufacturing and Repair Division.

Vice President William C. Rowland, formerly head of the Manufacturing and Repair Division, has been assigned responsibility for the Steam Division. Succeeding Rowland as manager of the "M & R" Division and its 40 plants throughout the country is Chris H. Bartlett. Bartlett formerly was assistant manager of the Westinghouse Transformer Division.

Under the new organization Ray H. Timmons becomes works manager of the Steam Division.

Rowland is a graduate of Texas A. & M. College where he received his B.S. degree in electrical engineering in 1929. He joined the Westinghouse graduate student course that same year and was assigned to the Meter Division in Newark, N. J., in 1930. In 1940, he was appointed superintendent of the Factory Service Division at the East Pittsburgh plant and manager of that division in 1943. He became manager of the Manufacturing and Repair Division in 1949 and was elected vice president in 1953.

Bartlett was graduated from the University of Colorado in 1928 with a B.S. degree in electrical engineering. He joined the Westinghouse graduate student training course that same year and after a brief period in sales at East Pittsburgh, was transferred to Emeryville, Calif., in the Transformer Sales Department.

In 1942 he moved to the Sales Department at Transformer Division headquarters where, two years later, he became manager of the Instrument and Specialty Department sales section. After heading the Specialty Transformer Department in 1946, he was named sales manager for the division in 1949. Bartlett managed the Transformer Division from 1952 until late 1953 when he was chosen to attend the Harvard School for Advanced Management. He returned as assistant division manager until his new appointment.

As works manager of the Steam Division, Timmons has 26 years manufacturing and engineering experience with Westinghouse. He was graduated from the University of Illinois in 1928 with a Bachelor of Science degree in railway electrical engineering. He joined the Westinghouse graduate student training course that same year and was assigned to railway engineering. In 1937 he was transferred to the Transportation and Generator Division as a manufacturing engineer, becoming superintendent of manufacturing for the division in 1939 and manager of manufacturing in 1943. In 1949 he was named manager of manufacturing for all industrial products divisions and was transferred to the Steam Division in 1952.

Powers Joins Koehring Company As General Manager In California

H. R. Powers has been named general manager of Koehring Company of California. Powers was domestic sales manager of the LeTourneau-Westinghouse Company prior to accepting the post. He will be in charge of all operations at the west coast Koehring subsidiary and is taking up his new duties immediately.

H. R. Powers

Powers has been associated with LeTourneau-Westinghouse for nine years. Beginning as a district representative, he was promoted successively to eastern sales manager and domestic sales manager.

BJ Service, Inc., Promotes Kirkpatrick and Lamkin

R. P. Kirkpatrick, formerly service supervisor of BJ Service, Inc.'s Tioga, N. D., station, became district superintendent of the Williston Basin district.

Howard N. Lamkin, formerly service engineer at the Ventura, Calif., station has been transferred to Worland, Wyo., as service supervisor.

Other recent changes within the organization include moving the Rocky Mountain division office from Casper, Wyo., to Billings, Mont. Casper remains an operating service station.

Delta Engineering Increases Houston Headquarters 25%

Work has been started on an addition to Delta Engineering Corporation's headquarters at 2121 San Felipe in Houston which will increase the company's space about 25 percent.

The new facilities will provide additional space for offices and engineering labs. The addition follows the same modern lines as the original building.

Employes Receive Service Pins

A lot of drilling history has been written since these veteran Hughes Tool Company men first represented the company in the oil fields. W. H. Siems, general sales manager, is shown presenting R. L. Long, manager of the Southern Region, with a 30-year service pin. W. L. Hunter, manager of the Northern Region, left, received a 25-year pin. The presentations took place during the recent meeting of Hughes Tool Company's regional managers in Houston.

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Complete Compressor Station

Two 600 H.P. Type L.V.G. Ingersoll-Rand gas engines with high pressure compressors. Engines and compressors complete including Parkersburg Building. Located twenty miles from Houston. Contact Petroleum Management Company, 565 San Jacinto Building, Houston, Texas. Phone: CHarter 4781.

■ Producing high grade shallow oil lease. 10 or more producers to drill yet. Sale disability. Joe Fechter, 1121 Const. St., Emporia, Kans.

■ Registered 5 year Federal Lands, Arizona, leases $3.00 per acre plus liberal bonus in well drilled to 3212 feet. Production expected in Pennsylvanian Limestone between 3500 and 4000 feet. For details write Mineral Development Project A, 3411 N. 14th Place, Phoenix, Arizona.

■ Super Electronic Magnetometer. Designed with high gain amplification for finding low magnetic highs or anomalies which have been undetectable in the past. One man can make a complete geophysical survey. Write for details, Super Electronic Scope Co., Rt. 11, Box 449, Fort Worth, Texas.

■ FOR SALE: Two R225 Climax Motors—radiators, starting motors, twin disc clutch—One completely overhauled $2750.00. One in good running shape, $2000.00. W. H. Martin, The Oil Corporation, 1220 South Staples, Corpus Christi, Texas.

■ Desirable Ozark property overlooking adjacent land with approx. half mile frontage on Arkansas Parkway—a valuable development potential. 60 acres, 8 room modern house, electricity, gas, on southeast slope, alluring views, two car garage, sealed & insulated storehouse, pump house, small barn, chicken house, living stream, deep well, pond, sheltered, climatically tops. Contact owner at Box 24-W, c/o World Oil, Houston, Texas.

■ FOR TRADE: Want to trade as down payment on complete Power Rig following equipment suitable for small rig—Shop made 97 ft. Derrick—Mogul Draw Works and Buda Motor—Two Climax motors and general equipment. W. H. Martin, The Oil Corporation, 1220 South Staples, Corpus Christi, Texas.

SITUATIONS WANTED

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

■ Employed subsurface geologist, experienced in seismic interpretation, desires employment with independent operator of independent oil company. Personal interview desired. Box 23-W, c/o World Oil, Houston, Texas.

BUSINESS OPPORTUNITIES

■ See A. L. Bowles, Ada, Okla., for Oil Investments, drilling deals. Can also use a large producing lease. Must have all data.

GEOPHYSICAL SERVICE

■ OIL LOCATING SERVICE! Determine approximate depth and thickness of oil zones. Drilling locations pin-pointed. NO OTHER GEOPHYSICAL WORK NEEDED! Documentary proof of success. WORTH INVESTIGATING! YOUNG AND CRITCHLOW, 1975 NW Everett, Portland, Oregon.

HELP WANTED

Seismologist

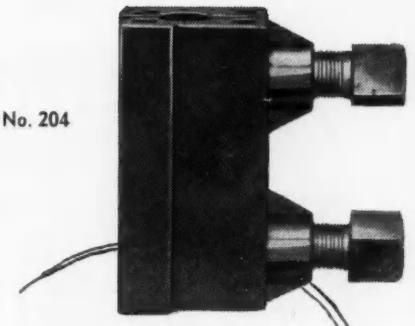
Major oil company needs experienced record interpreter with minimum of 2½ years seismograph experience and 6 months record picking. Our employees know of this ad. Box 16-w, c/o World Oil, Houston, Texas.

DECALS

■ TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

Use the Readers' Service Cards

For more information on New Equipment described in this issue, for copies of the literature reviewed, and for data on any advertised products, use the Readers' Service Cards on the last page, just inside the back cover. Circle on the card the editorial or advertising code numbers of the items desired. Sign and mail the card. Your requests will be forwarded to the manufacturer and the information will be mailed directly to you.

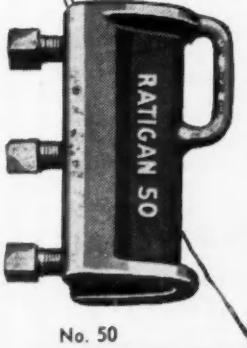


STRONG RUGGED *Never Fail!*

RATIGAN *Polished Rod* **GRIPS**

The No. 204 (above) . . . a 2-screw model, designed for present type pumping units which require a short, narrow gripping device with exceptionally high capacity. Weighs only 18 lbs., it is made in 2 sizes: for 1⅛"-1¼" polished rod; and for 1½" polished rod.

The No. 50 (below) . . . a 3-screw model also in 2 sizes for 1⅛"-1¼" polished rod; and 1½" polished rod. The No. 50 is an extra heavy duty model, designed for all depths with a large margin of safety.



No. 50

Properly installed, Ratigan Polished Rod Grips Never Fail!

SOLD THROUGH LEADING SUPPLY STORES

J. P. RATIGAN, Inc.
1213 Santa Fe Ave., Los Angeles 21
Export: National Supply Co., Inc., Export Div.
600 Fifth Ave., New York 20, N.Y.

RESISTS WEAR *and how!*

KENNAMETAL* BALLS and SEATS last from 2 to 5 times longer than conventional metals

Kennametal Balls, Seats, and conch shells have one remarkable characteristic in common: *High resistance to corrosion and abrasion.* "Problem" wells get steadier production, greater volume with Kennametal Balls and Seats because check valve failure is minimized. Effective resistance to wire drawing, corrosion, and shock give them a service life up to 5 times longer than "special" alloys.

So if you have a "problem" well, remember to ask your supplier or your pump manufacturer about Kennametal. Kennametal Inc., Latrobe, Pa.

KENNAMETAL* LIGHT-WEIGHT BALL

Made of corrosion-resistant titanium carbide, ⅓ lighter than steel. Minimizes down-well check valve trouble caused by ball flutter, cage wear, and fluid pounding.

KENNAMETAL*

REDUCES THE RISK OF SUB-SURFACE VALVE FAILURE

*Registered Trade Mark

Definition

"By golly," said the stranger at a dance, "what a long and lanky girl that is over there."

"Hush," his host whispered. "She used to be long and lanky—nowadays she's tall and stately. She just inherited half a million dollars."

Making the Most of It!

Plumber arriving three hours after the call: "How's things, Mr. Brown?"

The happy Mr. Brown: "Not so bad. While we were waiting I taught the maid how to swim."

More of Same

A Texan walked into the bar of a New York night club, saw a customer lying helpless on the floor, and pointing to him, said: "Give me some of that."

Another Version

Mother, do all fairy tales begin with "Once upon a time?"

No, darling. Sometimes they begin with "My love, I will be detained at the office tonight."

After FIVE dusters in a row, Mr. Shotts, I think a frozen custard stand is an excellent idea.

ROLO WELLCHECKERS

PERMANENT AND PORTABLE SEPARATORS FOR METERING OIL AND GAS

Trailer-mounted Wellcheckers: 1H—3607, 1H—2406 and 1H—1604

Made in various sizes and working pressures to fit any operation, Rolo Wellcheckers enable the operator to check well production daily and to secure accurate tax and royalty records. Rolo Wellcheckers are shipped completely piped and ready to operate.

Write, wire or phone Rolo today regarding your well testing and oil metering requirements. See Composite Catalog or send for new illustrated Bulletin.

Crude Oil Metering Specialists

ROLO MANUFACTURING COMPANY

P. O. BOX 6763, HOUSTON 5, TEXAS

BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Bakersfield, Casper, Mt. Vernon, Illinois, Calgary (Alta.)
Petroleum Industry Consultants, Apartado 3992, Caracas, Venezuela.
EXPORT OFFICE: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N. Y.

What's NEW

In Perforating, Logging, and Fishing Tool Services

McCULLOUGH
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

2 hours and 35 minutes

PROBLEM: New Well. Operator wanted well bullet perforated fastest way.

SOLUTION: McCullough 4¼" M-3 Bullet Gun Perforator shot 334 ½" holes in 7" 23-lb. J-55 cemented casing between 4013' and 3940'. Eight runs were made to perforate 73 feet of zone. (26' at two holes per foot and 47' at six holes per foot.)

RESULT: Job was completed during a snow storm in two hours and 35 minutes. Good well. Production figures not given.

NEW Perforators SOLVE Toughest Problems!

0 B/D to 120 B/D

PROBLEM: Well had been drilled, tested, plugged and abandoned. Another company, believing production was possible, bought old hole and set 5½", 17-lb. casing.

SOLUTION: McCullough Neutron Log located two thin potential zones. Both thin intervals were accurately perforated (48 shots total) in one run in the hole using McCullough Standard Casing Glass Jet Perforator and Steel Strip Carrier (10,032' to 10,038' and 10,042' to 10,048').

RESULT: Well came in flowing at 120 barrels per day.

McCULLOUGH

Perforating Service

M-3 Bullet Gun and Glass Jet *Perforators*

75 B/D to 250 B/D

PROBLEM: Well had been perforated through 7" casing by another company and was producing 75 B/D. 7" casing went bad and a string of 5" was run inside and cemented. The operator wanted to regain production.

SOLUTION: McCullough Super Casing Glass Jet Perforator and Steel Strip Carrier fired 176 shots at 9155' through both strings of casing and cement.

RESULT: Production was increased from 75 barrels per day to 250 barrels per day. Time on the job—two and one-half hours.

"World's Hardest Shooting"

Results after others failed

PROBLEM: Hard, shaley-sand had to be sandfraced to get production after perforating. Well had been perforated by another service company on three different occasions (four jet holes per foot). Formation would not break down under pump pressure up to 3000 lbs.

SOLUTION: McCullough Tool Company was called on the job. Twenty ½" bullets were fired, three holes per foot, by our M-3 Perforator.

RESULT: Formation broke down under 600 lbs. pump pressure. Time on the job—one hour. Resulting production —50 barrels per day.

For Best Results — Log AND Perforate — by McCullough

PERFORATING, RADIATION LOGGING, AND FISHING TOOL SERVICE—ANYWHERE—ANYTIME.

McCULLOUGH TOOL COMPANY

5820 South Alameda Street, Los Angeles 58, California
405 McCarty Street (P. O. Box 2575) • Houston, Texas

CABLE ADDRESS: MACTOOL
EXPORT OFFICE: Los Angeles, California

CANADA: Edmonton, Calgary, Grande Prairie, Alberta; Regina, Sask.
VENEZUELA: United Oilwell Service Co., S.A.; Caracas, Anaco, Maracaibo

SERVICE LOCATIONS: **TEXAS:** Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls, Luling, Beaumont, Sherman, Midkiff, El Campo. **OKLAHOMA:** Oklahoma City, Guymon, Healdton, Hominy, Wewoka. **ARKANSAS:** Magnolia. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper, Cody, Newcastle. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling. **NORTH DAKOTA:** Williston. **UTAH:** Vernal.

QUICK, ACCURATE RESULTS
LESS EFFORT
Curtin CENTRIFUGES

No. 3420
15 c.c. machine . . .
Cranks and heads interchangeable with 100 c.c. machines.

Simple in design . . . Ruggedly built . . . Requires no special care . . . Gear Ratio and throw of crank produce required speed with no strain. Curtin Centrifuges meet all A.S.T.M. Standard Method D-96 and A.P.I. Code No. 25 requirements. Fully descriptive literature upon request.

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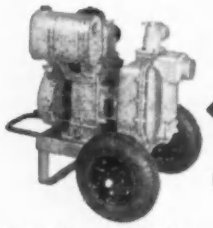
HOUSTON . . . . NEW ORLEANS.

PUMP TROUBLE ?

Switch to Marine Products Co.'s Flomax line of ruggedly constructed self-priming centrifugals to end pump breakdowns.
The FLOMAX pumps are designed to last—to give long life on nasty jobs. They're "Built for the Sea."

BELT DRIVE FROM AVAILABLE POWER



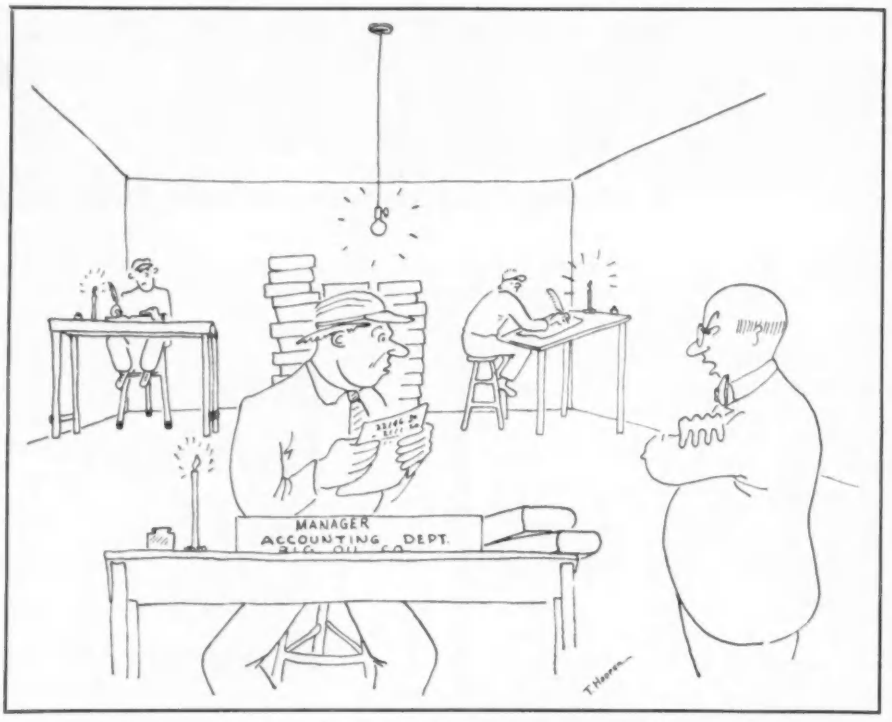
PORTABLE GAS ENGINE DRIVEN MODELS

- All Bronze and Cast Iron Bronze fitted models.
- Mechanical Seal and stuffing box styles.
- Stationary and mobile mountings.

MP MARINE PRODUCTS CO.

Available at leading oil field stores.

MARINE PRODUCTS COMPANY
515 LYCASTE AVE., DETROIT 14, MICHIGAN



"And what complaint does the Accounting Department wish to register this time?"

A Gentleman

"Did you get home O.K. last night?" asked the bus driver of a regular passenger.

"Sure. Why?"

"Well, when you got up and gave the lady your seat last night you were the only two people on the bus."

Rewarded

Kind Old Man: "Do you know why Santa Claus didn't bring you anything, little girl?"

Child: "Yes, damn it. I trumped father's ace in a bridge game on Christmas Eve."

Familiar Face

The attorney was examining a witness in court.

"Have you ever been arrested before?"

"No, sir!"

"Have you ever been in this court before?"

"No, sir!"

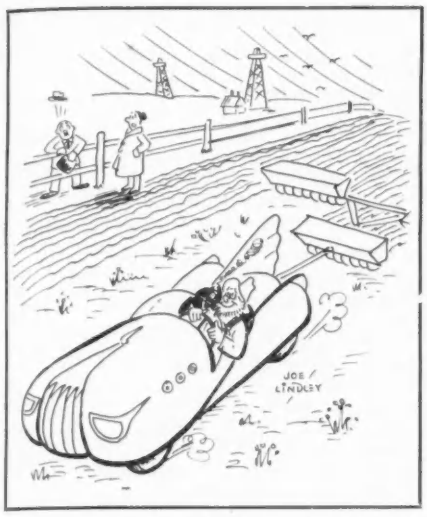
"Are you sure of that?"

"Yes, sir."

"Your face looks familiar. Where have I seen you?"

"Well, sir. I'm the bartender across the street."

"I DUNNO – I JUST CALLED IN LANE-WELLS AND THEY PERFORATED"



Ever since they struck oil on the place Pa refuses to use the tractor.

The Real Reason

It was married man's night and the minister asked that everyone who had domestic worries stand up.

"Ah!" exclaimed the minister, peering at the lone man who had remained seated, "You are one in a million."

"It ain't that," said the voice as the rest of the congregation gazed at him suspiciously. "I can't get up; I'm paralyzed."

At Last

A traveling man put up one night in a cheap little hotel, where the thin partitions of a range of bedrooms like the stalls of a stable stopped halfway to the ceiling And in the stilly watches of the night he lay awake and listened to the finest demonstration of plain and fancy snoring that it had ever been his fate to hear. It was full of sudden and awful variations. Sometimes strangulation seemed eminent; then in the middle of a fantasia, the agony stopped suddenly and there was silence. From a nearby room he heard a voice exclaim wearily: "Thank goodness! He's dead!"

Also Present

It was the eve of their wedding and the groom was angry because his bride-to-be was neglecting him in the bustle of last minute preparations.

"But darling," she soothed, "if our wedding is to be a success, we must not overlook the most insignificant detail."

"Oh, don't worry about that. I'll be there."

Kindness

A kindly English vicar saw a woman laboriously pushing a perambulator up a steep hill. He volunteered his assistance and when they reached the top he said in answer to her thanks, "Oh, it's nothing. I'm delighted to do it. But as a little reward may I kiss the baby?"

"Baby? Lor' bless you sir. It ain't no baby, it's the old man's beer."

Sounds Like the Irish

First kindergarten teacher: And how many children have you?

Second kindergarten teacher: Twenty-nine; and you?

First: Thirty-six.

Pat (in seat ahead, who had overheard the conversation): Say, what part of Ireland are you from?

INCREASE PRODUCTION

CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less down-time, use world famous Miller Sand Pumps.

PUMP & BAILER SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 inches.
Lengths—20, 25, 30 ft.

Composite Catalog Page 3433

Write for descriptive price list.

MILLER SAND PUMPS

MILLER SAND PUMP CO.
General Offices, Box 4516
Oklahoma City 9, Okla.
EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK CITY 20, N. Y.

Pump

Bailer

install
peak performance
into your
compressors (AIR • GAS • AMMONIA)

Peak performance, maximum efficiency, greater output, and lower power costs can be built into your oldest, and of course your newest, compressors by the installation of VOSS VALVES.

Check THESE VOSS VALVE ADVANTAGES:

✓ Quiet, vibration-free operation ✓ 20 to 60% more valve area ✓ less power consumption ✓ minimum pressure loss ✓ normal discharge temperature ✓ lower operating costs ✓ utmost safety

Our detailed proposal for increasing the efficiency of your compressor will be sent you without obligation. Send us the name, bore, stroke, and speed of your machine.

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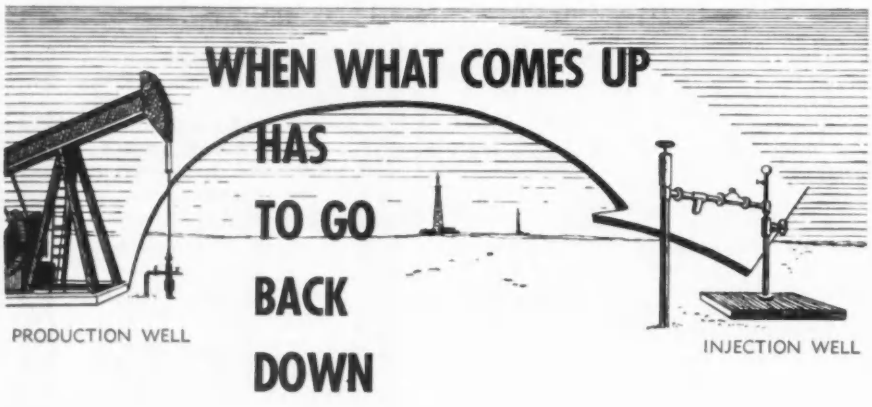
Analytical and Consulting Chemists
Hydrocarbon Gas Analyses, Reservoir Equilibria Studies for Crude and Condensate Well, Waters, Brines, Corrosion and Industrial Analyses.
Phone CApitol 1319, Box 132, Houston, Texas

New Books, Maps and Movies

OIL FOR TODAY AND FOR TOMORROW, Interstate Oil Compact Commission, Box 3127, Oklahoma City.

Dealing with the origin, production, conservation and importance of oil and gas, this booklet presents in condensed form the important aspects of the production and conservation problems in a manner for laymen to understand. Lt. Gen. Ernest O. Thompson, chairman of the Texas Railroad Commission, explains an important aspect of conservation—assurance of an adequate supply of oil and gas for national security and for freedom. The booklet is a compilation of chapters written by such authorities as General Thompson, George Hazlett, oil and gas attorney; H. H. Kaveler, petroleum engineer and management consultant; Harold B. Fell, independent operator and executive vice president of the IPAA, and officers and members of the staff of the Compact Commission. Bulk orders of the booklet will be filled at approximately cost of publication.



. . . Here's How To Cut Cost and End Trouble In Your Salt Water Disposal Wells!

Whether your salt water problem is re-pressuring or simple disposal, you can reduce overhead costs sharply by eliminating replacement expense due to corrosion losses. Have your new or existing tubing string lined with Tube-Kote's TK-43, the amazingly tough corrosion-proof lining. TK-43 gives your pipe years of life in either injection or production wells.

No other type of corrosion control gives you such complete protection: tubing lined with TK-43 is not damaged by brine, acids, alkalis, or crude; its sleek surface resists abrasion and ends flow-velocity erosion; its insulating properties stop electrolytic action caused by contact of dissimilar metals.

Write or call today for complete engineering data on other Tube-Kote linings and plastic pipe.

TUBE-KOTE, INC.
P. O. Box 20037 • Houston 25, Texas

TUBE-KOTE
First Name In Corrosion Resistance
TUBE-KOTE T.M. Reg.

CONDENSATE WELL CORROSION, NGAA Condensate Well Corrosion Committee, Natural Gasoline Association of America, Tulsa, 1953.

This book is an example of a technical problem yielding to the combined efforts of a large number of people banded together into a committee. The Corrosion Research Project Committee of the Natural Gasoline Association of America was formed more than 10 years ago when it became evident that corrosion in gas condensate wells constituted a serious and growing problem. This was a cooperative effort based on a desire to minimize costly damage and to aid in conserving a valuable natural resource. The committee determined the causative agents and that there was no corrosion in the absence of water; showed the influence of metallurgical factors and the effects of flow rate and temperature; found the several more or less typical corrosion patterns produced; and established the importance of the nature of the solid corrosion products. The committee was instrumental in developing methods for detecting, measuring and locating the corrosion in individual wells. The book contains numerous references to case histories which permit the reader to draw analogies in effect and in treatment.

•

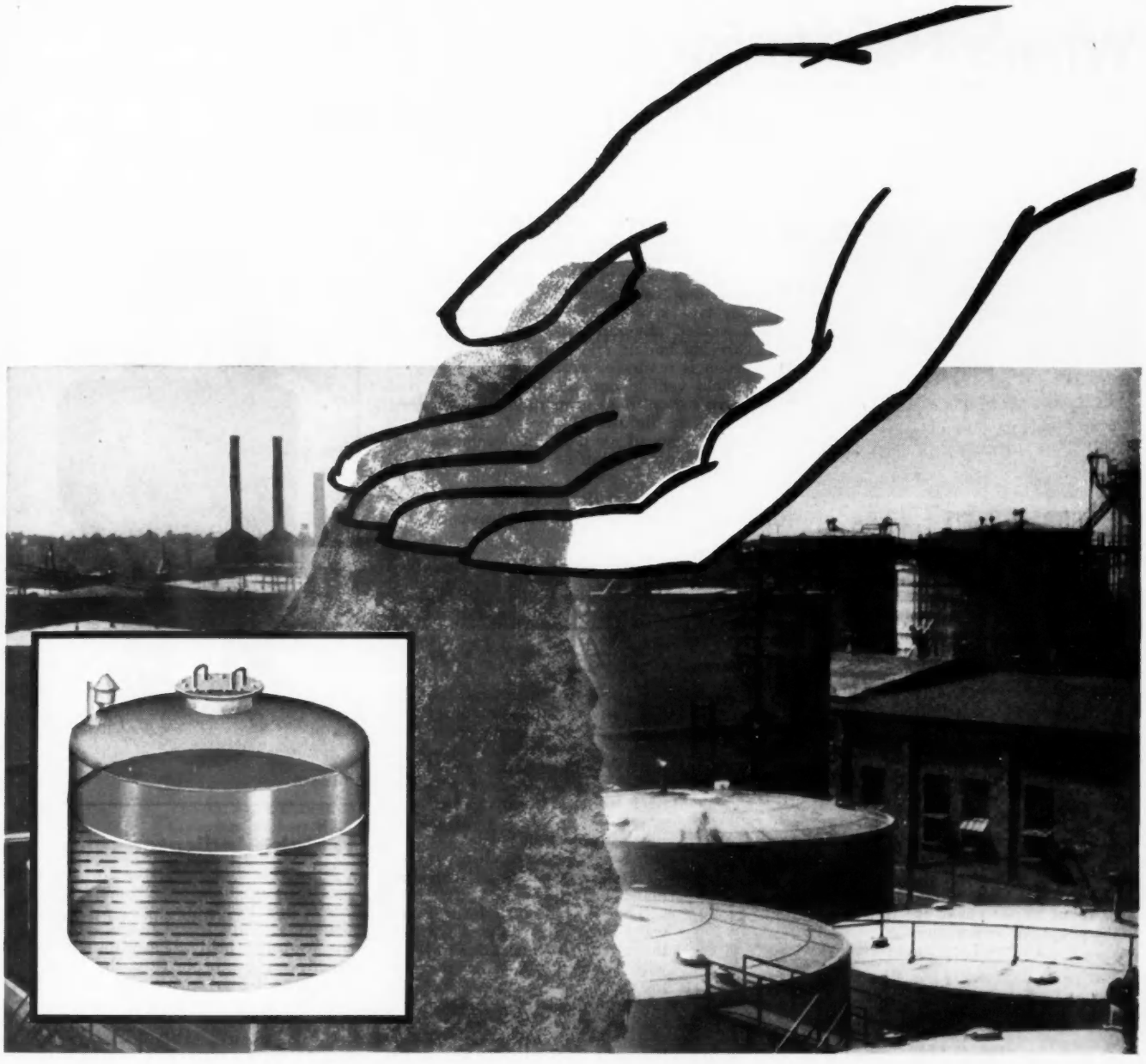
Pipe Line Maps, Commercial Drafting Service, P. O. Box 6277, Houston 6.

The series of maps of 47 Gulf Coast counties showing natural gas lines of South Texas has been completed. Each map base is a Land Office survey map with the pipe lines placed thereon as accurately as possible to survey corners and angles within surveys. These maps are drawn to the scale of the Land Office maps which are generally drawn to a scale of one-inch equals 2000 or 3000 varas. These are not field or ownership maps though field areas will be indicated where they affect pipe lines. This information is being compiled from each of the companies' alignment sheets or from other accurate sources obtained from each company. Prices will be furnished upon request.

•

COMPOSITION AND PROPERTIES OF OIL WELL DRILLING FLUIDS, Walter F. Rogers. Gulf Publishing Company, Houston, Texas, 1953. Revised edition.

Chapters on calcium treated muds and oil emulsion muds have been added to the initial manuscript published in 1947. At that time red-lime and oil-emulsion muds were just beginning to be used and little was known about them. These muds are both in comon use now and represent the greatest developmental advances in the past five years. Extensive revisions were made in most of the initial chapters and the new book is recmmended as a training and reference text to those interested in mud practices.



MICROBALLOONS* CUT EVAPORATION LOSS 80-90%

These tiny, hollow spheres of BAKELITE Phenolic Resin form a floating, vapor-stopping cover on the surface of crude oil. A half-inch layer in an 88-ft. diameter tank can save 2.34 barrels a day—*over 850 barrels a year.*

Additional savings result from the low initial cost—substantially less than that of any other method. Oil savings alone can write it off in less than a year. And, as an extra dividend, the original quality and properties of crude oil are retained throughout long storage.

Application is simple. The spheres are pumped into the tank with the oil. They float to the surface, forming a blanket that rises and falls with the oil level. It flows around internal supports, keeping the surface sealed as the level changes.

BAKELITE Phenolic Resin's resistance to oil keeps the spheres from filling and sinking. Tests show no deterioration in spheres floating on crude oil for over two years. Small size and non-abrading qualities prevent damage should the spheres be drawn into pipe lines and precision pumps. Used in cone-roofed tanks this floating cover cannot be affected by heavy snow or icing.

For complete information on these spheres in terms of your tank facilities, write Dept. XE-78. Our service representatives stand ready to assist you.

*Trade-mark The Standard Oil Company (Ohio)

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TRADE-MARK
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TRADE MARK
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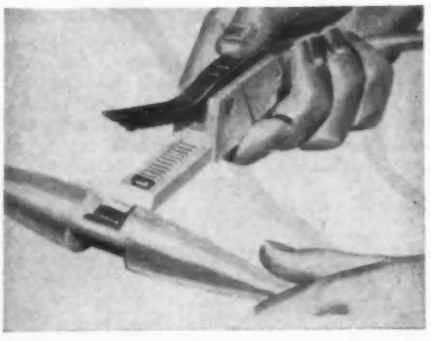
What's New in Equipment

Drilling • Production • Pipe Line



Geophone Clip

Vector Manufacturing Company is manufacturing the C-5 "Gator" geophone clip which helps geophysical crews speed up time in making geophone connections. For use with the Vector split spring cable take-out, the C-5 clip is designed to minimize costly field maintenance as well as assist operators in obtaining more accurate records. Its patented construction offers complete resistance to moisture, positive polarity identification and freedom from breakage and subsequent field repair.

The "Gator" clip automatically shorts when not on take-out, thereby affording electric damping protection to the geophone. In addition to its ability to work on small or large cables, the clip can be reused as often as desired or replaced when necessary. It is estimated that these units save about 50 percent of the time needed to make geophone connections.

For more data **circle No. E1** on Readers' Service Card, last page this issue.

Recording Oscillograph

Southwestern Industrial Electronics Company has announced the development of the PRO-11-10 recording oscillograph. The PRO-11-10 is equipped with 50 SIE precision galvanometers mounted in two 25 element blocks. This latest design in the field-proven PRO series offers maximum recording flexibility while maintaining light weight and sturdy construction.

Accommodating ten-inch paper and offering a wide range of paper speeds, the recording oscillograph can be used with any type system. The unit is contained in a welded aluminum case equipped with a carrying handle and watertight cover. Provision is made for permanent mounting in a field vehicle and the timing system and galvo structure are shock mounted for long life. The light-tight record magazine is easily removed for daylight developing and the oscillograph can be loaded in daylight.

For more data **circle No. E2** on Readers' Service Card, last page this issue.

DRILLING

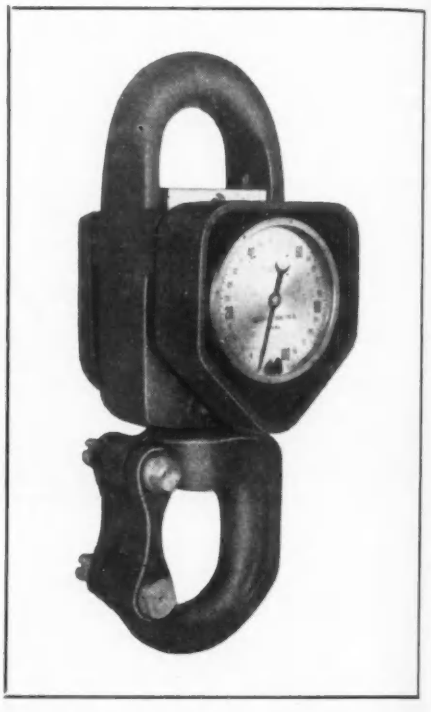
Rotary Jars

Sealed Type I Bowen rotary jars are straight pull mechanical type rotary jars which provide greater efficiency in jarring operation. The ability of these jars to strike heavy blows with a string completely free from torque eliminates any aggravating tendency to releave the fishing tool below the jar. Torque-free operation also reduces equipment wear and eliminates hazards.

The jars deliver heavy upward blows regardless of whether the string is elevated slowly or with rapidity. Wearing parts of the rotary jars can be replaced easily and the tool will regain all the properties of a new one. The tripping mechanisms are identical with those in the earlier types of Bowen rotary jars. The new jars differ in that they are filled with oil and sealed top and bottom against the ingress of well fluid. The moving parts of sealed type I Bowen rotary jars which are manufactured by S. R. Bowen Company work in a bath of oil producing advantages such as constant tripping tonnage, lubrication which practically eliminates wear on any other parts, and infrequent servicing. The floater automatically moves up or down the washpipe maintaining a pressure balance within the jar and avoids excessive pressures on the seals.

(This item supplements S. R. Bowen Company data on pages 825-868 of the Composite Catalog, 19th Edition.)

For more data **circle No. E3** on Readers' Service Card, last page this issue.



Weight Indicator

A new weight indicator for measuring hookloads up to 200,000 pounds has been introduced by Johnson-Fagg Engineering Company. This device meets the need for an accurate load measuring instrument which can be applied to the hook. The hook type J-F weight indicator allows the deadline to be tied to the traveling block, thus increasing the effective capacity of the mast. Especially desirable for use on portable servicing rigs, the J-F weight indicator is sturdily built for field handling, sealed against dust and moisture and only slightly affected by temperature changes.

The extreme accuracy of this instrument is advantageous for setting packers, setting tubing anchors, unseating pumps and handling of long strings of tubing. The instrument is simple to install and operate. The load is applied directly to the weight indicator ring through a hook assembly, causing the ring to deflect or compress in exact proportion to the applied load. As the ring deflects, this motion is magnified mechanically through a strut and ligature mechanism. Load is read directly in pounds. These instruments measure hookloads up to 200,000 pounds. A variety of sizes are available.

(This item supplements Johnson-Fagg Engineering Co. data on page 2701 of the Composite Catalog, 19th Edition.)

For more data **circle No. E4** on Readers' Service Card, last page this issue.

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. . . . UP to a high Standard of Performance— not DOWN to a price.

The economical Field Compressor installation is the one that does the job it is meant to do—does continuously over a long period; and requires the minimum amount of repairs and servicing.

Wilson Supply—Ingersoll-Rand Packaged Compressor installations are engineered to give the operator this standard of performance.

Furthermore—service engineers of Wilson Supply Company and Ingersoll-Rand are available should they be needed to keep shut-down time to a minimum.

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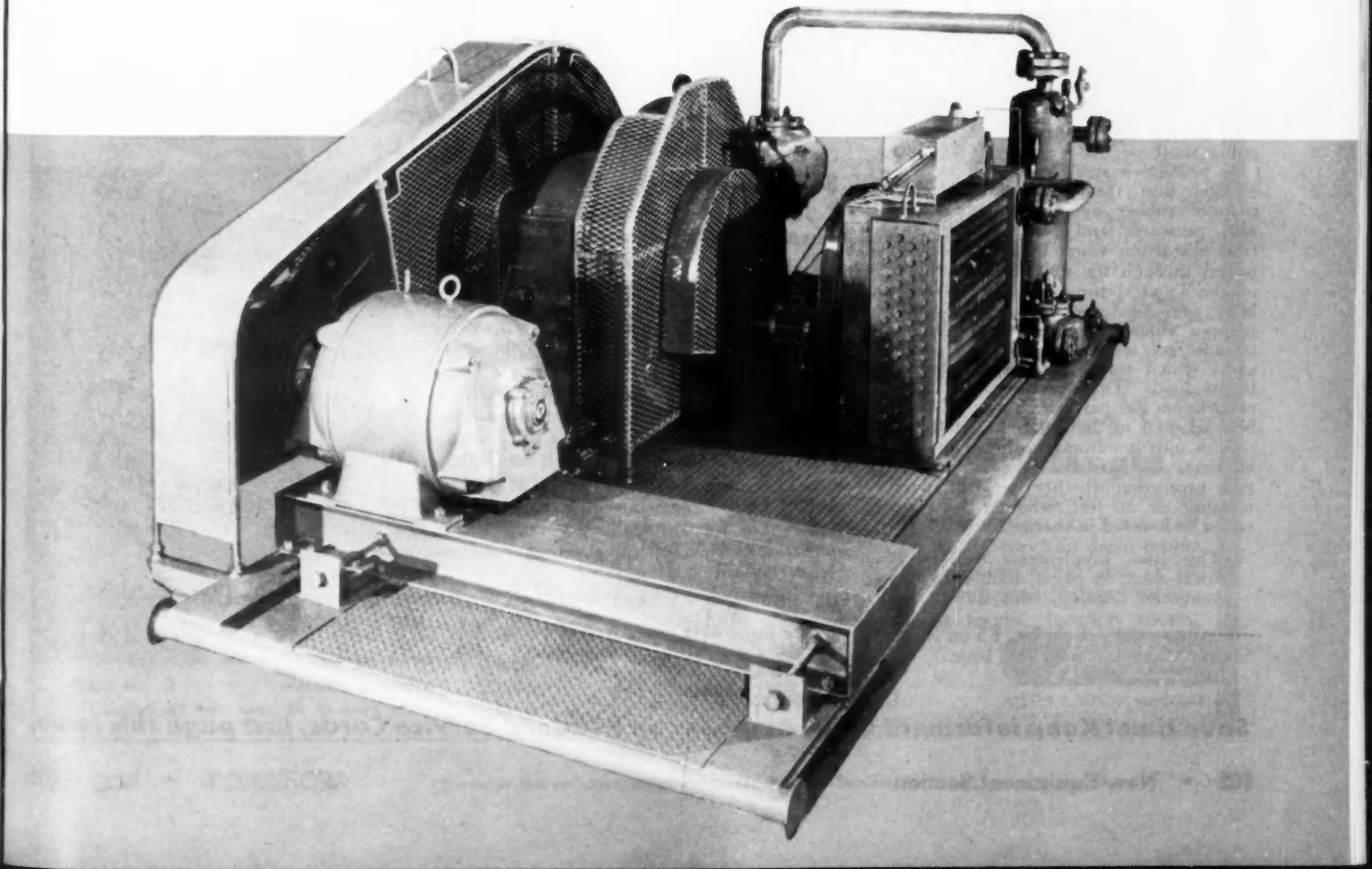

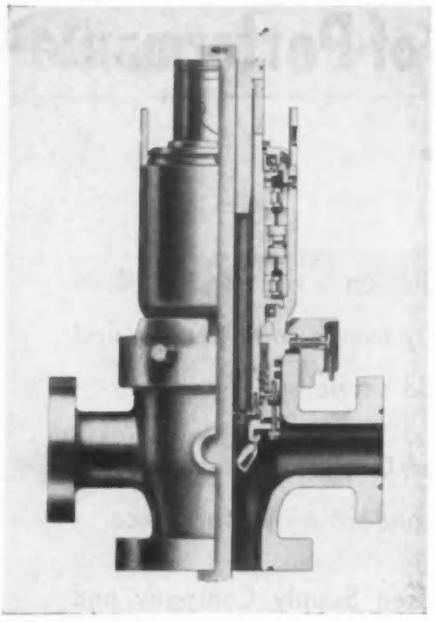

Blowout Preventer and Stripper

To meet demand for a smaller version of the Shaffer combination rotating blowout preventer and stripper, Shaffer Tool Works has announced the Type 51 combination rotating blowout preventer and stripper which is being used on such operations as slim hole drilling, workover jobs, drilling out operations, repair work and a wide range of similar drilling and production applications through casing diameters of 10¾-inch and smaller. The pressure sealing unit consists of a heavy duty stripper rubber which fits tightly around the drill string and prevents any pressure leakage. As well pressure increases, the stripper rubber is pressed more tightly against the circumference of the drill string, thereby serving to increase the sealing action. The stripper rubber expands and contracts automatically as the various diameters pass through it. Also, it automatically adjusts itself to maintain a pressure-tight seal around such varying shapes as square kellys and hex kellys, as well as the round elements in the drill string itself.

A protective steel barrier of steel lugs molded into the rubber reinforces the stripper rubber against damage by high well pressures and protects the rubber from distortion when large diameters are pulled through the unit. The sealing unit on the Type 51 preventer rotates with the kelly, minimizing wear and flexing of the stripper rubber. To assure long life and trouble free service, the bearing assembly upon which the unit rotates carries the thrust loads. Thus each type of load is carried on the particular type of bearing best adapted to the job requirements.

This unit is automatically on the job at all times and maintains the same pressure type protection whether the drill string is rotating or at rest, whether it is being raised or lowered in the well.

(This item supplements Shaffer Tool Works data on pages 4609-4688 of the Composite Catalog, 19th Edition.)

For more data **circle No. E5** on Readers' Service Card, last page this issue.

Pump Surge Alleviator

Knauth Oil Field Specialty Company announces the development of a heavy duty pump surge absorber designed especially for drilling rig pumps. The alleviator has ample capacity for the largest pumps and is obtainable unitized for easy installation anywhere in the pump line common to all pumps at the rig. A single flanging nut holds together two similar concave chambers and secures a dividing diaphragm.

The diaphragm is molded of soft rubber and circularly corrugated to allow a large displacement with only a slight bending and practically no stretching or molecular reversal of the rubber. The alleviator employs an intermediate liquid chamber. The liquid (water) serves as a flow surge dampener and as a fluid piston to compress and expand the gas charge in the upper chamber wherein sudden pressure changes are subsequently alleviated. The diaphragm chamber is designed as two identical concave halves and by spanning the openings of each chamber with identically perforated plates, flow surging of the intermediate liquid into and out of the diaphragm chamber is in harmony with the flow surging of the drilling mud. Unnecessary distortion of the diaphragm is prevented.

The intermediate liquid seals the gas from the diaphragm and dissipates any internal molecular heat developed by rapid flexing of the diaphragm. A circular closing shoe of reinforced hard rubber is secured coaxially to the diaphragm to seat over the perforated plate in the mud chamber and thereby retaining the gas charge during pump shut-down. The alleviator is cast of alloyed and heat treated steel and pressure tested at 8000 psi. Skids are 3½ to 7 feet and overall height is 6½ feet. Total weight unitized is 1730 pounds.

For more data **circle No. E6** on Readers' Service Card, last page this issue.

Scintillator

The model 118 "Royal Scintillator" manufactured by Precision Radiation Instruments, Inc., is designed to define the limits of an oilfield and eliminate need for drilling many dry holes. It also will locate uranium deposits and can be operated from an aircraft or a moving vehicle. The instrument is contained in a small case weighing 24 pounds. It employs a 2¼-inch diameter Thallium activated sodium iodide crystal as its detecting element and incorporates a scaling circuit as well as a ratemeter. Its ranges are .01, .025, .05, .1, .25 and 1 mr/hr. The scintillator has a counting rate of 500,000 counts per minute in a one mr/hr field of radiation. A bulletin is available.

For more data **circle No. E7** on Readers' Service Card, last page this issue.

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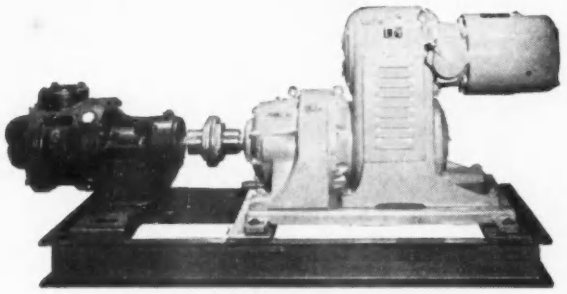
An Interesting VIKING Unit



Viking Pumps are leaders in service to the Oil Industry . . . tops in performance and dependability.

Shown here is a versatile unit of the heavy-duty style designed to handle thin or viscous liquids. Capacity ranges from 10 GPM to 1050 GPM with pressure to 200 lbs. This unit shows totally enclosed vari-drive with a wide speed range.

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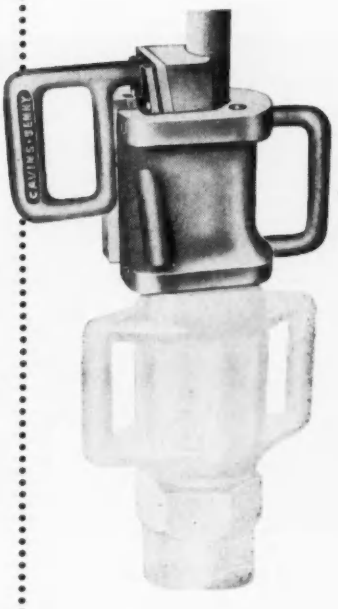
SELF-TIGHTENING — Weight of rods pulls wedge into position in body.

SELF-RELEASING— Clamp removed by relieving the load and lifting the wedge.

Adaptable for setting, servicing or permanent installation. 25,000 lbs. A.P.I. rating.



CAVINS

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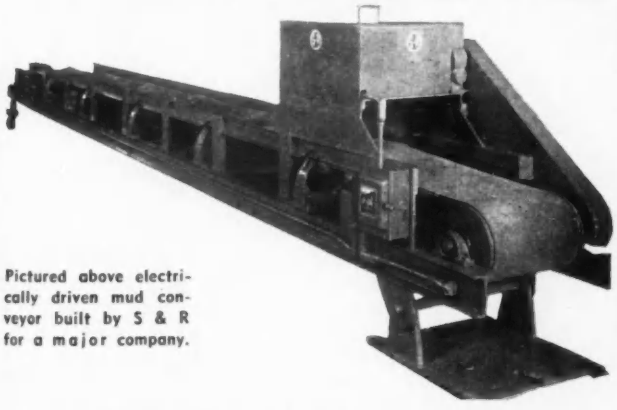
S & R SPECIAL *Custom Built* MUD CONVEYORS FOR DRILLING BARGES



Pictured above electrically driven mud conveyor built by S & R for a major company.

Here's the answer to efficient movement of mud for your drilling barge—it's S & R's custom-built, electrically-powered, chain-drive mud conveyor.

Built for heavy duty service with quality materials equipped with reversible belt, troughing idlers, protected easily accessible drive housing. Operates efficiently all positions to 35° off horizontal. Built-in sizes to 40 feet.

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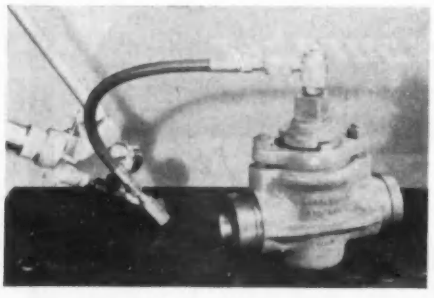
JOSEPH F. DUDDY, MANAGER

PRODUCTION

Brake and Wiper

Edd Higgins of Kermit, Texas, has announced the new "Higgins Safety gauge line brake and wiper." Approved by safety departments, this new brake and wiper eliminates cut hands and oily rags. By pressing the braking lever, the gauge weight can be instantly stopped in its descent to the bottom of the tank without injury to hands. As the oily gauge line is reeled to the surface after gauge has been taken, another lever causes soft rubber rollers to wipe the line clean. The rollers last for months and are easily replaced. The savings in rags alone will pay for the device in a short time.

For more data **circle No. E8** on Readers' Service Card, last page this issue.



Valve Lubrication Aid

A new button head coupler for use with Rockwell high pressure lubricant hand guns and bucket pumps has been introduced by Rockwell Manufacturing Company. The new coupler has a shut-off device to stop all extrusion of lubricant from the coupler immediately after removal from the fitting. Known as the Rockwell "400" button head coupler, the new device has one-fourth inch pipe thread pull-on and top connections.

(This item supplements Rockwell Manufacturing Company data on pages 3777-3812 of the Composite Catalog, 19th Edition.)

For more data **circle No. E9** on Readers' Service Card, last page this issue.

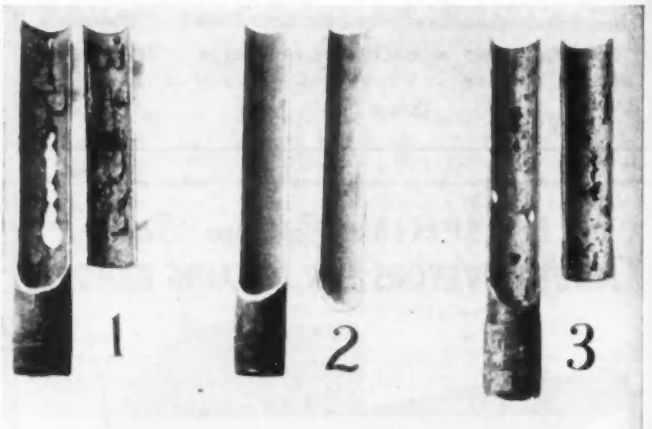
Pumping Units

Features of Alten Foundry and Machine Works' redesigned and expanded pumping units for 1954 include a newly-designed adjustable counterbalance; bronze bushed four-way adjustable saddle bearing; choice of helical or herringbone gears; safety type horsehead; and foolproof automotive type brake. The counterbalance can be adjusted by one man on the ground in a matter of minutes. Crank calibration locates weights for desired counterbalance; weights cannot fall during adjustment as they are locked and held in position at all times.

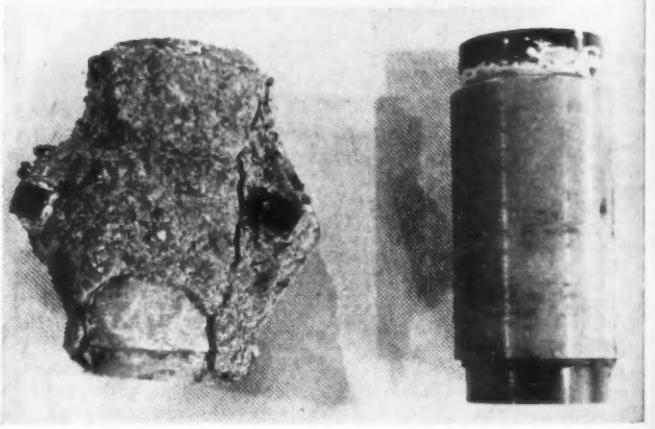
(This item supplements Alten Foundry and Machine Works, Inc. data on pages 201-208 of the Composite Catalog, 19th Edition.)

For more data **circle No. E10** on Readers' Service Card, last page this issue.

Fibercast Pipe



Severe corrosion by salt water and hydrogen sulfide that quickly destroys metal pipe in oil fields has little effect on a new type reinforced thermosetting resin pipe. Developed specifically to combat corrosive conditions that exist in oil fields, this new pipe is made by a centrifugal molding process developed by The Fibercast Corporation, a subsidiary of The Youngstown Sheet and Tube Company.



Because of the chemical resistance of Bakelite polyester resin, the new pipe is not affected by sulphur and salt-laden fuels, oil and oil products, natural gas, soil alkalies and acids. By centrifugally molding these resins with Fiberglas mat, favorable burst, collapse, beam and tensile strengths are also obtained. Lighter than steel or aluminum, Fibercast pipe has a greater strength-weight ratio than any metal used in construction.

Sections of steel and Fibercast tubing removed from disposal wells handling 500,000 barrels of salt water per month from the Arbuckle-Lime formation of northern Kansas have proved the greater corrosion resistance of the new type pipe. Cement-lined tubing removed after 14 months' service was corroded beyond repair by the salt water (top photo, number 1). Scale almost one-quarter inch thick had formed on the walls, impeding flow in the pipe. Fibercast tubing endured the same corrosive attack

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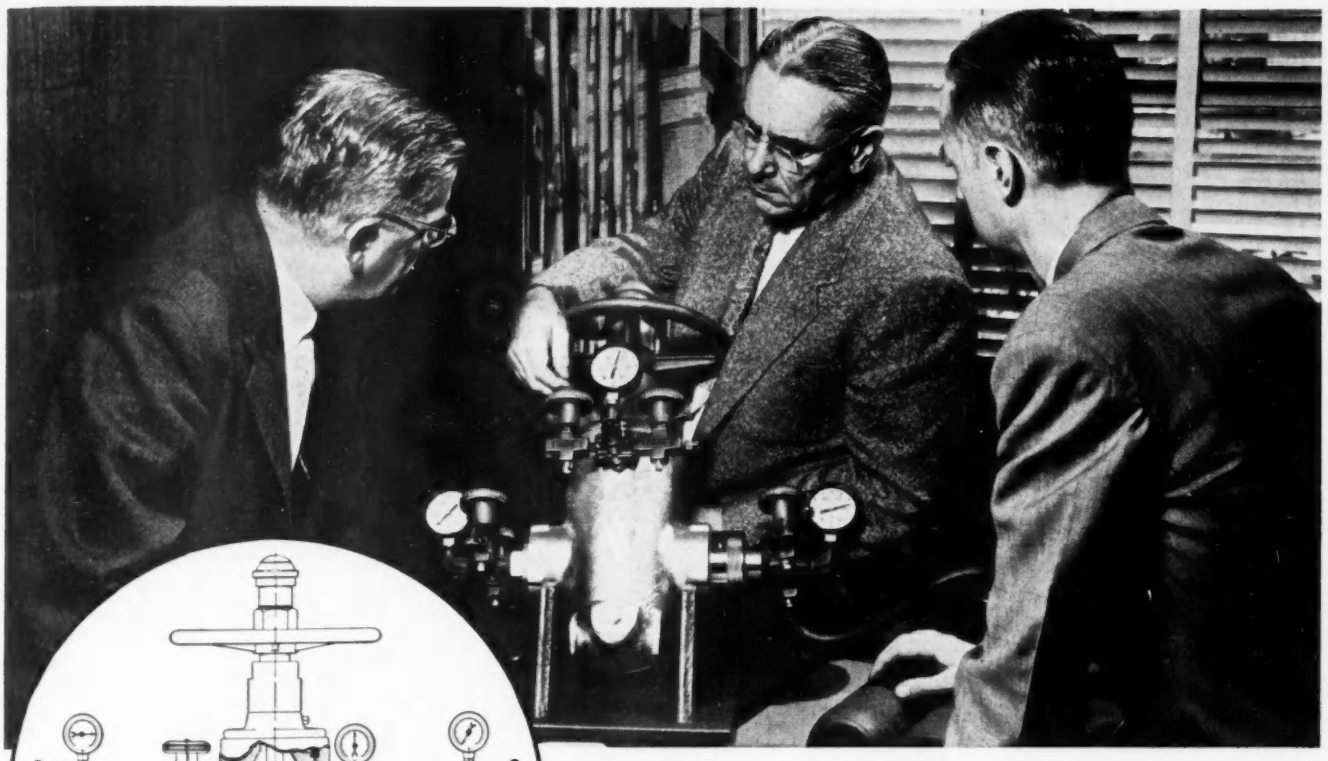
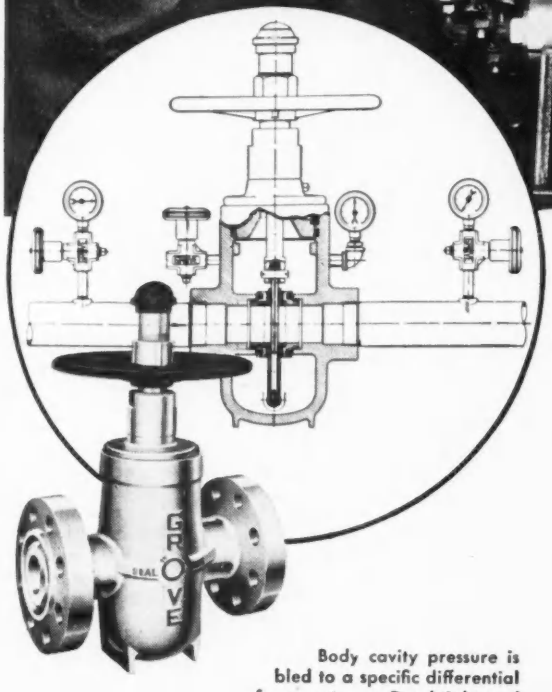
WE'LL MAKE THIS TEST WHEREVER YOU SUGGEST





Body cavity pressure is bled to a specific differential from upstream. Dead-tight seal is verified by non-variance of cavity pressure gauge.

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Your Grove sales engineer is equipped to demonstrate this new field method of testing and checking the dead-tight seal and free-moving gate action of Grove Seal-"O"-Ring Gate Valves—*right in your office*, or wherever you suggest. Simulating actual conditions, this test proves conclusively that Grove Seal-"O"-Ring Valves hold tight as a line blind, yet permit free movement of the hand-wheel at all times. Also, excess body cavity pressure is automatically relieved *internally* to the upstream line by piston-action of Seal-"O"-Ring seat assemblies, actuated by pressure differential. This test set-up shows how you can install this system for checking Grove valves right in the line—at any-time—without loss of gas or liquid. You must see it—to believe it. Contact your nearest Grove District Office today, to arrange for test demonstration.

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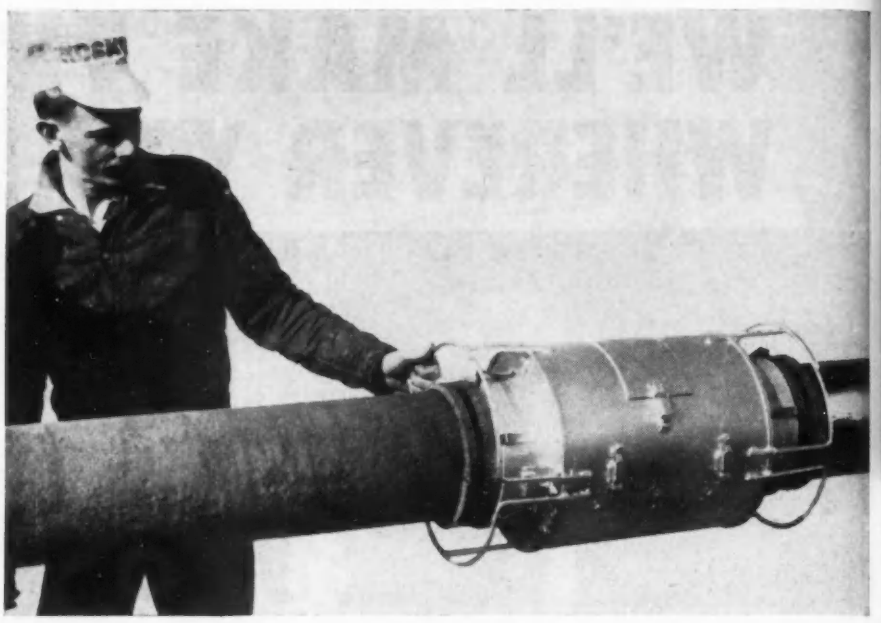
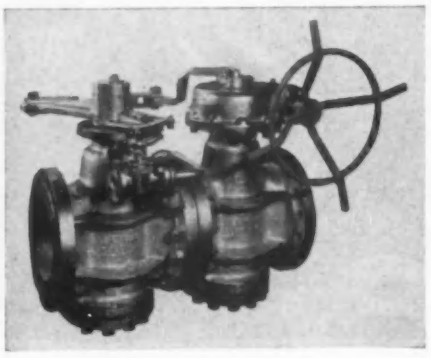
for 14 months without any trace of corrosion, scale formation or paraffin deposit (top photo, number 2). Plastic coated tubing under the same conditions (top photo, number 3) broke down after only nine months' service and also developed considerable amounts of scale. Aluminum couplings on Fibercast line pipe were buried in salt-laden ground. Dug up six months later, the completely deteriorated aluminum coupling was peeled off of the unharmed pipe (bottom photo, left). New threaded couplings also molded of glass fiber reinforced with Bakelite polyester resin are now available (bottom photo, right).

For more data **circle No. E11** on Readers' Service Card, last page this issue.



PIPE LINE



Rockwell Blind

A new blind designed to increase the safety and simplicity of mechanical blinding operations in fluid product piping transfer systems has been introduced by Rockwell Manufacturing Company. The Rockwell blind consists of two straightway Nordstrom Hypreseal valves butted together in series and operated in unison through a common linkage. A bleeder valve located between the two Hypreseals is operated through the same linkage in such a way that when the two block valves are turned to the closed position, the bleeder is automatically opened. The Rockwell blind is the first to offer a double block with automatic bleed, eliminating shut-off of upstream and downstream valves and bleeding the section between blinds. Drainage losses also are avoided.

Use of the new blind obviates the necessity for precise piping alignment to prevent binding in the blind. As a safety feature, particularly where LPG is used, the blind prevents pressure build up and the resulting hazards of conventional blinds. A tamperproof locking device and simple one-wheel operation are cited as advantages of the new device.

(This item supplements Rockwell Manufacturing Company data on pages 3777-3812 of the Composite Catalog, 19th Edition.)

For more data **circle No. E12** on Readers' Service Card, last page this issue.

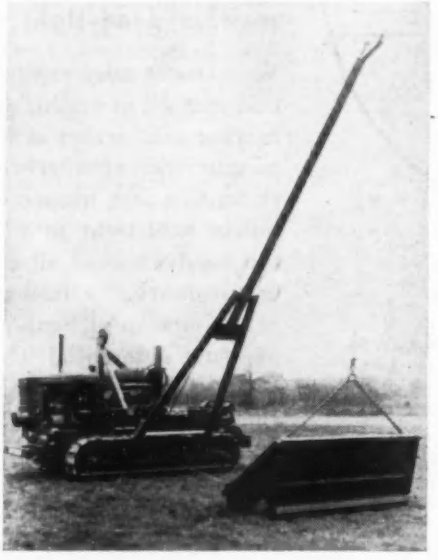
Coating Device

Roskoter, a new pipe line coating device, designed specifically for application of their Roskote cold-applied mastic, has been introduced by Royston Laboratories, Inc. The Roskoter is a hollow cylinder which can be fitted around any size pipe up to 12-inch. Interchangeable coating shoes lined with special, heavy-duty carpets are secured to each end of this cylinder. Adjustable draw-bands control film thickness of the coating.

Recent field tests show that the Roskoter reduces manhours involved in pipe coating up to 80 percent, with a resulting saving of at least 50 percent in over-all costs. Roskoter provides uniformly distributed coating around the pipe circumference, assuring coverage of the pipe bottom which often is missed in other methods. No mastic is spilled or wasted.

One man can operate the Roskoter on smaller pipe and only two are needed on pipe up to 12-inch. It is easily cleaned, portable, easy to handle, and available in small, medium and large sizes. Each size unit can be fitted with coating shoes for different diameters of pipe.

For more data **circle No. E13** on Readers' Service Card, last page this issue.



Backfiller

Announcement of a one-man-operated backfiller for pipe lines and heavy construction work has been made by The Cleveland Trencher Company. The new machine, the Cleveland Model 190, is a fast bickfiller under all types of project conditions; it is effective under more rugged conditions—in mud, sand and rocky soil, in swamps and hilly terrain. Employing a seven-foot backfill board, the machine backfills as it travels, providing continuous operation under one-man control. The 190's transmission provides 48 crawler speeds from one foot per minute to 4.3 miles per hour in either direction. It is powered by a husky 467 cubic inch diesel engine which develops 79 horsepower at 1400 revolutions per minute.

Four separate transmission-controlled line speeds are available for both pull-in and throw-out cables ranging from 47 feet to 450 feet per minute. The adjustable boom can be telescoped from 19 feet to 27 feet and can be removed easily for eight-feet hauling width. As a side crane the 190 has a 50,000 ft. pound capacity figured from the edge of the crawler—10,000 pounds 5 feet out, 5000 pounds 10 feet out. Its spring-cushioned winch drum hand brake provides steady control for crane work.

(This item supplements The Cleveland Trencher Company data on page 1281 of the Composite Catalog, 19th Edition.)

For more data **circle No. E14** on Readers' Service Card, last page this issue.

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